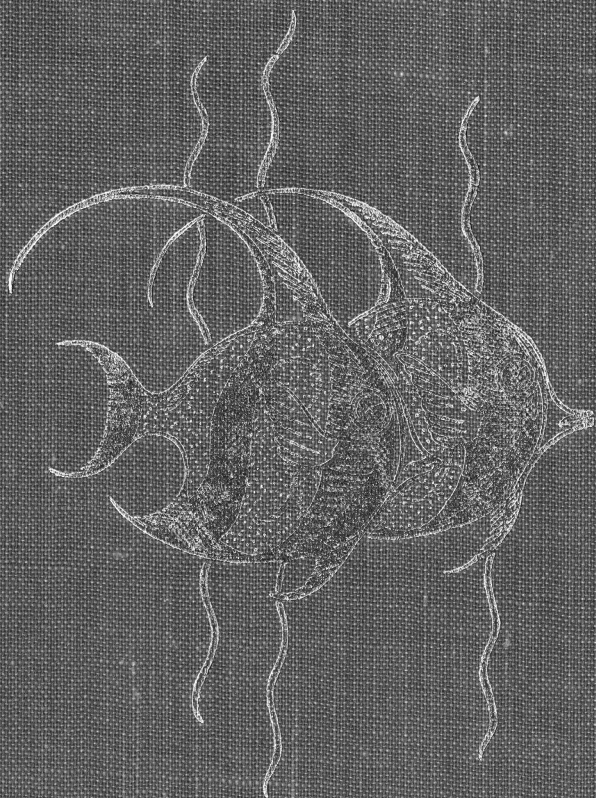


ICHTHYOLOGICAL PAPERS

OF J. L. B. SMITH 1931-1943



VOLUME 1

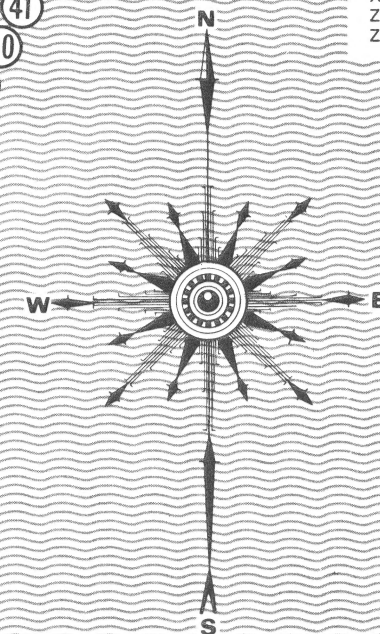
SOUTHERN AFRICAN SEAS

Agulhas Cape, 13
 Algoa Bay, 20
 Amanzimtoti, 37
 Bashee, 29
 Bazaruto Island, 51
 Beira, 52
 Bredasdorp Coast, 14
 Buffalo River, 26
 Bushmans River, 22
 Camps Bay, 8
 The Cape, 9
 Cape Agulhas, 13
 Cape of Good Hope, 9
 Cape Padrone, 21
 Cape Point, 9
 Cape Town, 7
 Chalumna River, 25
 Dassen Island, 6
 Delagoa Bay, 49
 Durban, 39
 East London, 26
 False Bay, 12
 Fish Point, 24
 Great Fish Point, 24
 Great Kei River, 27
 Inhaca, 47
 Inhambane, 50
 Isipingo, 38
 Kalk Bay, 10
 Kei Mouth, 27
 Kei River, 27
 Knysna, 17
 Kowie River, 23
 Kosi Bay, 45

1 Swakopmund
 Walfish Bay
 2 Port Nolloth
 3 Lamberts Bay
 4 St. Helena Bay
 5 Saldanha Bay
 6 Dassen Island
 7 Cape Town
 8 Camps Bay
 9 The Cape
 Cape of Good Hope
 Cape Point
 10 Kalk Bay
 11 Simons Bay
 12 False Bay
 13 Cape Agulhas
 14 Bredasdorp Coast
 15 St. Sebastian Bay
 16 Mossel Bay
 17 Knysna
 18 Plettenberg Bay
 19 Tsitsikama
 20 Algoa Bay
 21 Cape Padrone
 22 Bushmans River
 23 Kowie River
 Port Alfred
 24 Great Fish Point
 25 Chalumna River
 26 Buffalo River
 East London

27 Kei Mouth
 Great Kei River
 28 Transkei
 29 Bashee
 30 Xora River
 31 Umtata River
 32 Umgazi River
 33 Port St. Johns
 34 Pondoland
 35 Port Shepstone
 36 Umkomaas River
 37 Amanzimtoti
 38 Isipingo
 39 Durban
 Umgeni River
 40 Umhlanga
 41 Tugela River
 42 Zululand
 43 Richards Bay
 44 St. Lucia Bay
 45 Kosi Bay
 46 Maputoland
 47 Inhaca
 48 Ponte Mahone
 Ponte Maone
 49 Delagoa Bay
 Lourenço Marques
 Polana
 50 Inhambane
 51 Bazaruto Island
 52 Beira
 53 Zambezi River

Lamberts Bay, 3
 Lourenço Marques, 49
 Maputoland, 46
 Mossel Bay, 16
 Plettenberg Bay, 18
 Polana, 49
 Pondoland, 34
 Ponte Mahone, 48
 Ponte Maone, 48
 Port Alfred, 23
 Port Elizabeth, 20
 Port Nolloth, 2
 Port Shepstone, 35
 Port St. Johns, 33
 Richards Bay, 43
 St. Helena Bay, 4
 St. Lucia Bay, 44
 St. Sebastian Bay, 15
 Saldanha Bay, 5
 Simons Bay, 11
 Swakopmund, 1
 Transkei, 28
 Tugela River, 41
 Tsitsikama, 19
 Umgazi River, 32
 Umgeni River, 39
 Umhlanga, 40
 Umkomaas River, 36
 Umtata River, 31
 Walfish Bay, 1
 Xora River, 30
 Zambezi River, 53
 Zululand, 42



J. L. B. SMITH

ICHTHYOLOGICAL PAPERS

1931—1943

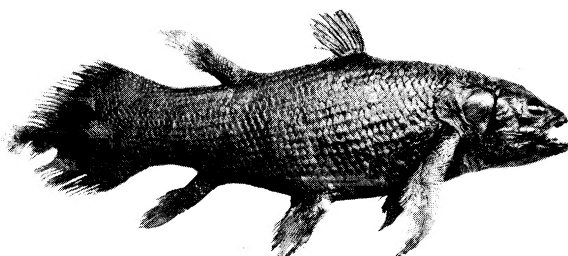
J. L. B. SMITH

ICHTHYOLOGICAL PAPERS

1931—1943

Vol. 1

Edited by
Margaret M. Smith



PUBLISHED BY THE J. L. B. SMITH INSTITUTE OF ICHTHYOLOGY
RHODES UNIVERSITY · GRAHAMSTOWN
1969

VOLUME 1

Contents

	PAGE
New and little known fish from the south and east coasts of Africa. <i>Rec. Albany Mus.</i> 4 (1): 145–160 Pl. 16. <i>January</i> 1931	1
An interesting new myctophid fish from South Africa. <i>Trans. R. Soc. S. Afr.</i> 21 (2): 125–127 Pl. 9. <i>April</i> 1933	17
The South African species of the genus <i>Hemirhamphus</i> Cuv. <i>Trans. R. Soc. S. Afr.</i> 21 (2): 129–150 Pls. 10–12. <i>April</i> 1933	21
The growth changes of <i>Pteroplatea natalensis</i> , G and T. <i>Trans. R. Soc. S. Afr.</i> 22 (1): 83–87 Pl. 4. <i>August</i> 1934	43
Marine fishes of seven genera new to South Africa. <i>Trans. R. Soc. S. Afr.</i> 22 (1): 89–100 Pls. 5–6. <i>August</i> 1934	49
The Triglidae of South Africa. <i>Trans. R. Soc. S. Afr.</i> 22 (4): 321–336 Pls. 16–23. <i>December</i> 1934	61
The fishes of the family Mugilidae in South Africa. <i>Ann. S. Afr. Mus.</i> 30 (5): 587–644 Pls. 15–22. <i>February</i> 1935	77
The “galjoen” fishes of South Africa. <i>Trans. R. Soc. S. Afr.</i> 23 (3): 265–276 Pls. 13–17. <i>September</i> 1935	135
New and little known fishes from South Africa. <i>Rec. Albany Mus.</i> 4 (2): 169–235 Pls. 18–23. <i>May</i> 1935	147
Fresh-water fishes of eastern Cape Province in <i>A guide to the vertebrate fauna of the eastern Cape Province South Africa. Part II Reptiles, Amphibians, and Freshwater Fishes</i> : 119–141 Pls. 29–34. 1937. Albany Museum, Grahamstown	215
The South African species of the family Aluteridae. <i>Rec. Albany Mus.</i> 4 (2): 358–364 Pls. 40–42. <i>May</i> 1935	238

PAGE

The genus *Tripteron* Playfair. *Trans. R. Soc. S. Afr.* **23** (4): 303–310 Pls. 21–23. 245
February 1936

Two interesting new fishes from South Africa. *Trans. R. Soc. S. Afr.* **24** (1): 1–6 253
Pls. 1–2. June 1936

New gobioid and cyprinid fishes from South Africa. *Trans. R. Soc. S. Afr.* **24** (1): 259
47–55 Pls. 3–5. June 1936

New records of South African fishes. *Ann. Natal Mus.* **8** (2): 167–197 Pl. 11. May 269
1937

Acknowledgements

I wish to express my appreciation:

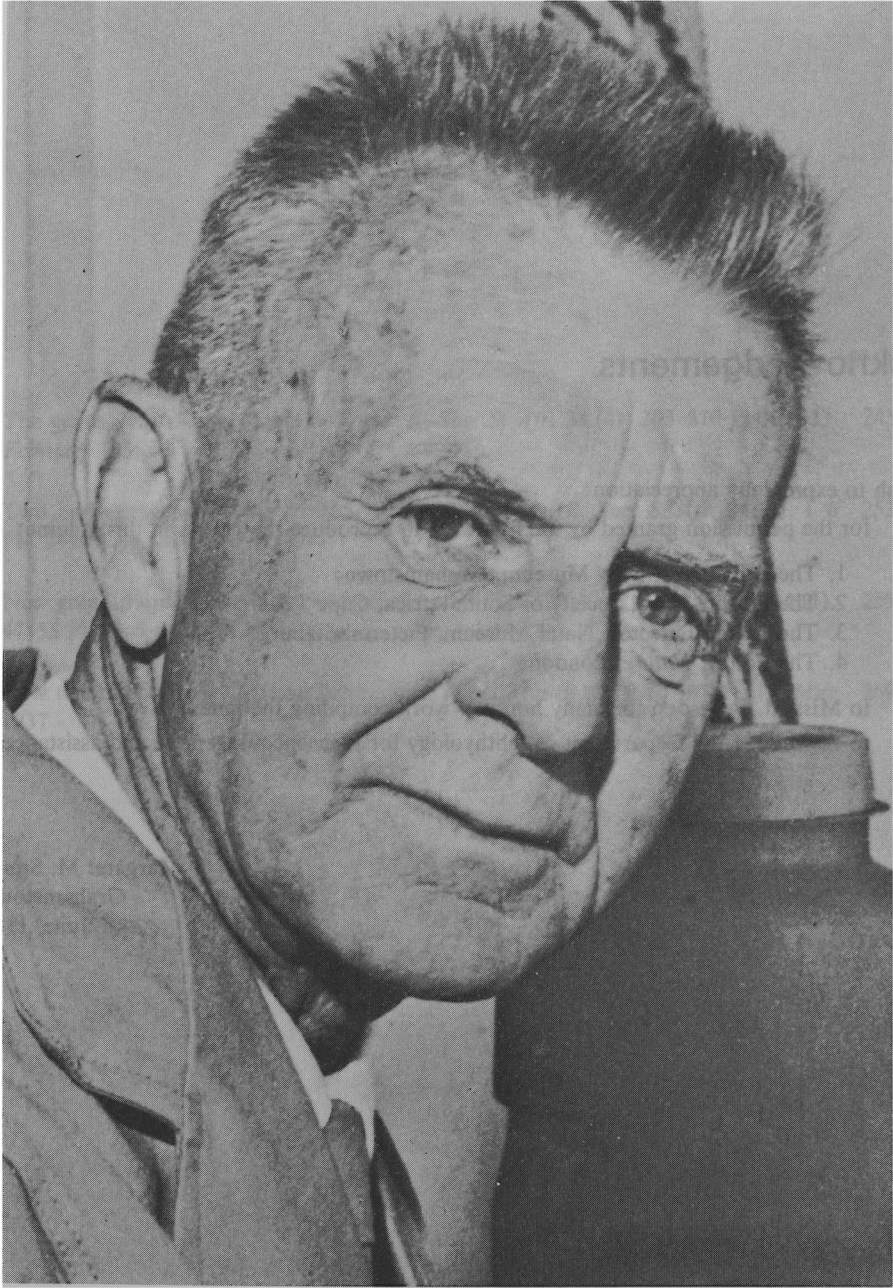
for the permission granted by the following to reproduce the papers in this volume:

1. The Director, Albany Museum, Grahamstown;
2. The Editor, Royal Society of South Africa, Cape Town;
3. The Acting Director, Natal Museum, Pietermaritzburg;
4. The Editor, *Nature*, London;

to Miss M. Igglesden for many hours of work compiling the index;

to the staff of the Department of Ichthyology for their encouragement and assistance.

Margaret M. Smith,
Grahamstown.
June, 1968.



[Handwritten signature]

JAMES LEONARD BRIERLEY SMITH was born in Graaff-Reinet, Cape Colony, on September 26, 1897, and died in Grahamstown on January 8, 1968.

His love of fishes dated back to when, as a small boy at Knysna, he caught his first small silvery fish (*Diplodus sargus*). From then on angling and fishes became a passion that lasted until the end of his life.

After an outstanding career in Chemistry, when by means of bursaries and scholarships, he put himself through Stellenbosch and Cambridge Universities, he returned in 1923 to lecture at Rhodes University College in Grahamstown. He was a brilliant, inspiring and much loved lecturer and teacher, and an indefatigable research worker. As such he came up against the "Old Guard" who had graduated to Chairs in the College from being school teachers, and looked askance at scientific research work. The turning point of his life probably came when he refused to spend his own precious time washing up students' apparatus at the end of the year but offered to pay an unskilled person to do his share!

When the Chair of Chemistry fell vacant, he was passed over. The only two members of the Senate who had doctorates, Professor S. Schönland, head of the Botany Department, and Professor J. E. Duerden, head of the Zoology Department, both fought bitterly to have Smith appointed to the Chair, but they were overruled, the excuse being that Organic Chemistry was a static subject of the past with no future! A Physical Chemist was appointed. Thus Chemistry's loss proved ultimately to be Ichthyology's gain.

Time he would have spent on administration was given to research in Chemistry during official (and some unofficial) hours, and in Ichthyology during his spare time.

He published his first short ichthyological paper in the Records of the Albany Museum in 1931, illustrating it himself with what he considered reasonable sketches.

H. W. Parker, the herpetologist at the British Museum who was a student with him at Cambridge, wrote saying he was surprised to see a chemist publishing a paper on fishes. The text was quite good but the illustrations were terrible! For the next ichthyological paper he produced, he spent many arduous hours over the illustration which he redrew a number of times. The result (*Myctophum (Nasolychnus) florentii*) was certainly worth all the trouble. He continued to illustrate his own papers until 1941. From 1943 with the *Early Juvenile Stadia* his wife, Margaret Mary, began illustrating his publications. Little did she realise where that was to lead her!

These two volumes represent the first phase of his ichthyological researches. During the war (1939-45) most of his time had of necessity to be given to teaching Chemistry, and at this period he published three Chemistry text-books.

In September 1945 he was invited to produce a book on South African fishes.

He had arrived at the parting of the ways. The newly formed South African Council for Scientific and Industrial Research made it possible for him to devote all his time to Ichthyology. He was given a grant of £800 p.a. to be renewed annually. It carried neither pension nor other benefits, and he lost his government pension due to him after 25 years of teaching because he refused to state that he was retiring from teaching on medical grounds.

But to the end the Council for Scientific and Industrial Research which had taken over the old "Research Grant Board" that had assisted him with these early papers, supported his work in every way.

In 1946 The Department of Ichthyology was founded and built up round his work. From 1946–1949 while busy writing *The Sea Fishes of Southern Africa*, he published seven more ichthyological papers in the Annals and Magazine of Natural History, London. These have not been included here as they are regarded as belonging to the second phase of his ichthyological work. Although *A neutral solution of formaldehyde for biological purposes* was published in 1947, it was read in 1944 and has been reprinted at the end.

In two big monographs in volume 2, viz. *The South African fishes of the families Sparidae and Denticidae* and *A living coelacanthid fish from South Africa*, Smith's personal copies have been used for reprinting and his own corrections have been reproduced. In the rest of the papers minor typographical errors have been corrected.

Records of the Albany Museum. Vol. IV. No. 1. pp. 145-160.
Pl. XVI. January, 1931.

**New and little known fish from the south and east coasts
of Africa.**

BY J. L. B. SMITH, M.Sc., Ph.D.

(With Plate XVI.)

FAMILY GRAMMICOLEPIDAE.

Prionolepis n.g.

Body ovate, deep, very compressed. Anterior ridges on head and body strongly serrate. Scales small, embedded at right angles to the skin, with serrulate recurved upper edge. Whole of head and body scaly. Spinous and soft portions of dorsal and anal united; spines of dorsal, anal and ventrals stout, with serrated ridges. No spines on body at base of median fins, but alternate scales at base of dorsal and anal enlarged. Ventrals thoracic, reduced to a pair of spines and a few rudimentary rays. Mouth small, terminal horizontal. Gills 4, a slit behind the 4th. Gill membranes united to the isthmus. Gill rakers moderate, slender. Branchiostegals few, reduced. Pseudobranchiae absent. Lateral line obscure. Nostrils paired.

This genus appears to be intermediate between *Xenolepidichthys* Gilchrist and *Vesposus* Jordan or somewhat closer to the latter, but is sharply distinguished from the other genera of the family by the character of the scales. This singular family now contains four monotypic genera, two of which are South African.

Prionolepis hewitti n. sp.

Body ovate, deep, very compressed. Dorsal profile elevated. Depth $1\frac{1}{2}$, length of head 3 in length of body. Maximum width of body at shoulder, 10 in length of body. Eye 2 in length of head, slightly greater than snout, twice interorbital width. Mouth small, terminal horizontal. Maxilla non-protractile, extends to almost below anterior nostril. A single series of small vertically implanted incisors in each jaw. Small teeth in bands on vomer. Dentigerous pharyngeals present. Nostrils paired, circular, close

together in a pentagonal depression before the orbit, edges of this depression serrate. Pre- and supra-orbital ridges serrate. 2 serrated ridges from snout to base of spinous dorsal; similar ridges from the chin to the ventrals. 2 small ridges on snout, each with 3 very small recurved spines. Gills 4, a slit behind the 4th. Gill rakers moderate slender, about 13 on lower limb of anterior arch. Gill opening normal, membranes joined to the isthmus. Branchiostegals 3 much reduced. Pseudobranchiae absent.

The scales are small, embedded at right angles to the skin, and have a denticulate recurved upper edge. The whole of the head and body is scaly. Lateral series 91., lateral tr. $\frac{1}{3}\frac{1}{9}$:18 longitudinal series on cheek: lateral line tubules about 35. Lateral line gently curved, very obscure on posterior half of body. Alternate scales at bases of dorsal and anal much enlarged and sharply ridged.

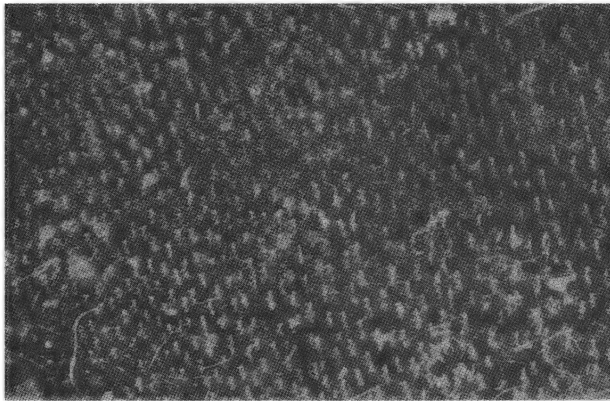
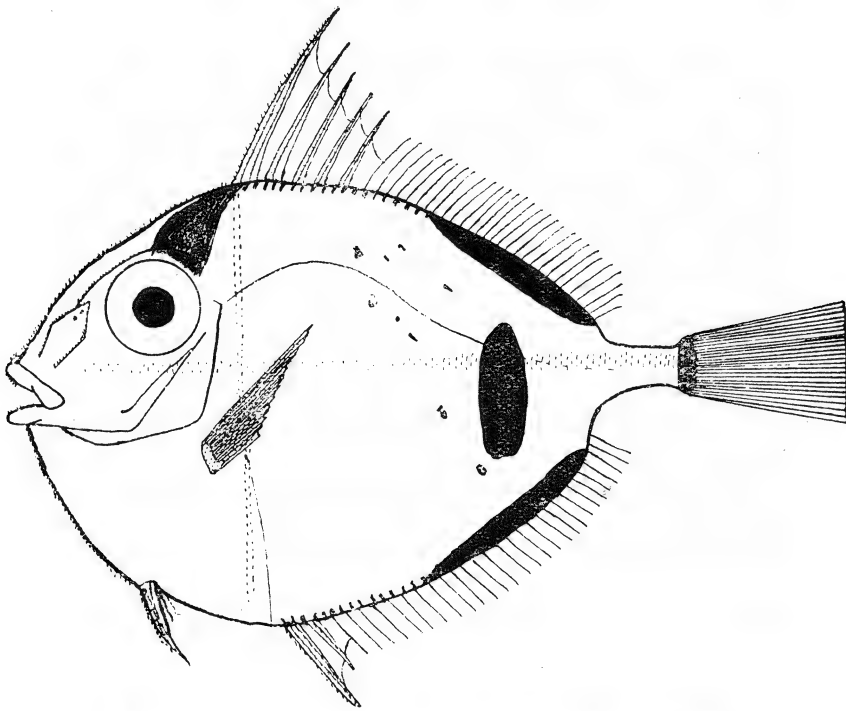
D V 29. Commences above hind margin of opercle. 1st spine longest slightly less than head, has 2 anterior and on each side two ridges, each with recurved spinelets. The remaining spines decrease in length to the 5th which is about half the length of the first. The 2nd—5th spines have on each side a ridge of recurved spinelets. The soft rays which are simple, uniform and somewhat shorter than the 5th dorsal spine, have on each side a row of recurved raylets.

A II 28. Commences below the 3rd dorsal spine. 1st spine half the length of, and similar in structure to, the first dorsal spine. 2nd spine subequal and similar to the 5th dorsal spine. Rays slightly shorter than, but exactly similar to the soft dorsal rays.

P 17, $\frac{2}{3}$ length of head, rays simple, base immediately below hind margin of opercle.

V I (2 or 3), thoracic, rays rudimentary. Spines similar to and slightly shorter than the first anal spine.

Caudal truncate, rays 26, similar in structure to dorsal and anal rays, each having a lateral row of recurved raylets on each side. Peduncle tapering posteriorly, subequal to eye.



Prionolepis hewitti n. sp. x 2½.

Below : scaling of right side, x about 7.

Colour. Light yellowish; abdominal area and operculum dull silvery. A black blotch above the orbit, tapering to a point at the base of the spinous dorsal. A narrow black bar across the posterior part of the caudal peduncle. A black transverse band across the posterior third of the body, about half the depth at this point, and about one third wide as long. A narrow black irregular band below the posterior $\frac{3}{4}$ of soft dorsal and anal, following the dorsal and anal profiles. A few isolated angular dark spots on the body. Fins light yellow.

Sex and condition cannot be determined without dissection, although the specimen is almost certainly juvenile.

A single specimen, 40 mm. in length,* cast up during a storm at Great Fish Point.

Type and only known specimen in the Albany Museum.

*In all these descriptions, length of body excludes the caudal fin.

FAMILY SOLEIDAE.

Synaptura barnardi n.sp. (Pl. XVI.)

Dextral. Body lanceolate. Depth $2\frac{3}{5}$, length of head $4\frac{1}{3}$ in length of body. Eye 7 in head, $1\frac{1}{4}$ in snout, about twice inter-orbital width. Upper eye in advance of lower slightly more than half eye diameter. Lower and anterior border of lower eye with a filamentous fringe. Snout blunt, rounded, scarcely hooked. Cleft of mouth extends to below the centre of the lower eye: posterior margins of lips on coloured side fringed. Teeth very minute on jaws on blind side only. Anterior right nostril tubular: posterior with a fringed flap. Anterior left nostril surrounded by a fringed flap, developed behind covering a naked groove.

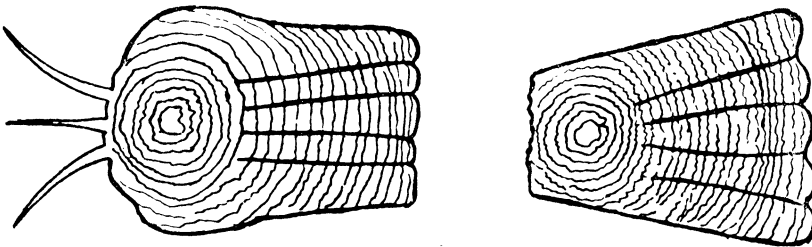
Preopercle hidden below the skin. Opercular margin strongly fringed on blind side: lightly fringed on upper margin on coloured side. Opercular membrane joined to the upper margin of the base of the pectoral on the blind side. On the coloured side, the membrane is joined to the body well below the base of the pectoral and forms an extraneous fold which extends upwards obscuring more than half of the base of the pectoral,

D. 78. Commences on the snout in front of the lower margin of the upper eye: rays articulated, membrane slightly incised. Anterior rays short, graduated: middle anterior rays $3\frac{1}{2}$, posterior rays 4 in length of head. On the blind side, all the rays have a membranous fringe joined to the body at the base of the fin: fringe more pronounced anteriorly. Fin joined to the caudal.

A. 57. Rays similar to the dorsal rays.

Pectorals small but well developed: right pectoral 8 in length of head, left pectoral very slightly longer, about 7 in head.

Scales small, strongly ctenoid on coloured side, a few on the head and along the lateral line bearing short filamentous process. 11 about 110. Scales on the blind side rounded or very feebly ctenoid. Lateral line very gently curved, almost straight, extending to above the preopercle on the right side. On the blind side, the lateral line is similar as far as the head, where it bifurcates, one branch turning down to near the corner of the mouth, the upper branch, at 180° to the lower, extending slightly obliquely back to near the base of the dorsal and then curving sharply forwards.



Right side.

Blind side.

Scales of *Synaptura barnardi* n.sp.

Caudal lanceolate, slightly rounded, 2 in length of head.

Colour. On the right side the ground colour is light grey. Some very small isolated brownish spots on the head and body. Irregular very small white spots chiefly along the lateral line and on the anterior upper part of head and body. Median fins slightly darker at base, outer margins lighter: regular series of

light and of dark dots on the base of dorsal and anal. Caudal with close set dark spots, margin lighter, end brownish. Right pectoral light with reddish margin. Ventrals light.

A single specimen 86 mm. in length from Great Fish Point, in very shallow water.

Type in the Albany Museum.

This species is very close to *marginata* Boulenger, but differs in the very small pectorals and in the presence of the curious fold in the opercular membrane on the right side.

It is noteworthy that many species of "Soles" are abundant in shallow water on the coast about Great Fish Point. The reefs of rock are very low at this point extending with very little fall some hundred yards below low water mark. Sand accumulates between the rocks, and fair numbers of "Soles," up to a length of 500 mm., are obtained by wading out from knee to thigh deep in the water at low tide, and stabbing these patches of sand with a "spear," resembling a pitchfork. The specimen described was secured in this manner.

FAMILY SCORPIDIDAE.

Neoscorpis n.g.

Body oblong-ovate. Mouth small, terminal. The outer series of teeth in the jaws more or less enlarged and lanceolate. An upper and lower pair of dentigerous pharyngeals well developed. Minute teeth in bands on vomer and palatines, maxilla expanded posteriorly. Gill rakers moderate. Dorsal spines 6-8, in a deep groove, increasing in length posteriorly: soft portion longer than spinous, anterior rays subfalcate forming a prominent lobe. Anal spines graduated, soft rays similar to those of the dorsal. Anal dorsal and caudal scaly. Differs from *Scorpis* C. and V. in the absence of serrations on the preopercle, in the absence of lingual teeth, and in the smaller number of dorsal spines.

A South African genus with one species, now recorded from Knysna to the Natal coast.

Neoscorpis lithophilus G. and T.

Stone-fish (Natal), Butter-fish (Eastern Province).

1908 Gilchrist and Thompson. Ann. S. Afr. Mus. vol I, p. 162.

1917 *ibid.* Ann. Durb. Mus. vol. I, pt. 4,
p. 365.

1925 Barnard. Ann. S. Afr. Mus. vol. XXI, p. 663, pl.
XXVIII, fig. I.

Depth $2\frac{1}{2}$ (Juv.) —2 (Ad.), length of head $3\frac{1}{2}$ (Juv.) — $4\frac{1}{2}$ (Ad.) in length of body. Eye 3—4 in length of head, in Juv. less than, in Ad. equal to snout; 1 (Juv.) — $1\frac{2}{3}$ (Ad.) in interorbital width. Snout obtuse, interorbital prominent. Maxilla extends to below anterior border of eye. Teeth in bands in both jaws, outer row enlarged, lanceolate. Whole of head except interorbital space, snout and chin, scaly. Soft dorsal, soft anal and caudal scaly. Very fine naked groove at base of soft dorsal. Gill rakers 12-13 on lower limb of anterior arch. Pyloric caeca very numerous and long. Scaly process in axil of ventrals ill defined in young examples D VI—VIII, 20—22. Spines short and stout, increasing in size posteriorly. Anterior rays, almost length of head, subfalcate forming a prominent lobe. A III 23—26. Spines short and stout, graduated. 1st spine 3 and 3rd spine 1 in eye diameter. Anterior soft rays equal and similar to dorsal rays. Lateral line almost straight. Scales II 90—97, l. tr. $\frac{20}{37}$ $\frac{24}{40}$

Colour. Silvery grey. In young often 7—8 faint dark cross bars equal to the interspaces. Interorbital darker with a broad light grey space on dorsal area. Ventrals light, remaining fins dark grey. Soft dorsal, soft anal and caudal with a black marginal band about one-sixth of eye diameter. Membrane of dorsal spines black. Iris yellow. A semi-circular black mark on the hinder margin of the operculum.

Locality. Knysna, Port Alfred, Great Fish Point, Isipingo, Natal coast.

Distribution. South and south-east coasts of Africa.

I have been fortunate in securing a well graduated series of specimens ranging in length from 44 to 468 mm. The number of dorsal spines appears to be commonly six, rarely seven or eight.

This species is fairly common among rocks in shallow water; very young specimens appear to be most plentiful during the middle summer months. On the coast south of Natal, it is a somewhat rare capture on lines, but is frequently secured by net and spear at night with the aid of a light. It is esteemed as a food fish, the flesh being of fine texture and of excellent flavour. In April 1929, after a flood in the Great Fish River had caused considerable pollution of the sea for some miles west of the mouth, a number of specimens of this species was taken by hand in the shallow surf near the mouth of the river by a party of anglers. The specimens were alive but evidently suffering from partial suffocation induced by the amount of fine particles of clay in suspension in the sea water. At these times, the sea is coloured from red to deep brown, and relatively large numbers of immature fish of various species are cast up dead by the waves, while the larger specimens appear to desert temporarily the normal angling spots.

FAMILY BLENNIIDAE.

Blennius fascigula Barnard. (Pl. XVI.)

'Rocky' (Eastern coasts).

1925. Barnard. Ann. S.A. Museum, vol. XXI, p. 834.

Depth 4—4½, length of head 3¼—4 in length of body. Eye 3½—4 in length of head, slightly greater than interorbital width, slightly less than snout. Profile of head very abruptly descending. Maxilla extends to below anterior third of the eye. Canines in both jaws, those in the lower jaw slightly larger: canines visible in even very small specimens. No occipital filaments. Nasal tentacles short, fimbriate. Supraorbital tentacles with a short flattened stalk, widening above and bearing 5—6 filaments, total length equal to the eye. Interorbital concave, groove extending to the snout. A shallow transverse groove behind the orbits: another very shallow transverse groove before the base of the dorsal. Gill membranes united forming a fold across the throat. LL. anteriorly a double row of pores.

D. XII. 19—22, commences above the hinder margin of the preopercle, very slightly notched between the spinous and soft portions. Dorsal not joined to the caudal.

A. II. 20—22. The two spines in the male enveloped in thick spongy skin. 1st spine obscure in females. Caudal rounded.

Colour. Ground colour yellowish, 7 (Type 5) vertical cross bars about equal to the interspaces from the middle of the side extending on to the base of the dorsal. A variable longitudinal series of dark spots in pairs below the bars. Irregular dark spots on the lower part of the body. Small dark spots on the head, on the dorsal and on the base of the pectoral. Anal dark with projecting ends of the rays light. A dark tapering spot at the base of each alternate anal ray in some cases. Caudal light immaculate. A dark bar across the chin. Two dark bars across the throat; the hinder bar sometimes bifurcates on the side, and in some specimens a faint cross bar shows across the base of the ventrals. Usually a dark spot between the first and second dorsal spines.

Length up to 85 mm.

Locality. Cove Rock, East London.

The species is founded upon a not too well preserved juvenile specimen from an unknown locality, and the original description is therefore necessarily somewhat inadequate. Neither the type nor my specimens show three clear cross bars across the throat, besides the one on the chin. A number of specimens from this locality which agree generally with this amended diagnosis of the species, show no sign of bifurcation of the hinder band on the throat, while in some cases the two bands have almost run into one large blotch. Pending the collection of further material these specimens are at present assigned to this species. The specimen figured is one in which the hinder band does not bifurcate.

It may be remarked that specimens collected recently on the south-eastern coasts of Africa indicate that a revision of the African species of this genus is desirable, since certain diagnostic features employed for the delimitation of species appear to be somewhat inconstant, and would, if maintained with

material recently collected, involve an unnecessary multiplication of species.

Further material is at present being collected with a view to such revision.

FAMILY CLINIDAE.

Clinus agilis n. sp. (Pl. XVI.)

'Klip-fish' (South-west). 'Rocky' (Eastern coasts).

Body moderately elongate, compressed. Dorsal profile gently curved from snout to base of anterior dorsal spines, with a slight hump above the hind margin of the preopercle. Depth 4—5 length of head $3\frac{1}{2}$ —4 in length of body. Eye 3—4 in head, $1\frac{1}{2}$ times snout, almost twice interorbital width.

Snout moderately sharp, sub-conical: very slight interorbital prominence. A slight groove from snout to interorbital. Two very shallow v-shaped grooves on occiput. Mucous pores on head prominent. Cleft of mouth oblique: jaws sub-equal: maxilla extends to below anterior third or centre of eye. A broad band of small teeth in both jaws, outer row enlarged: a curved band on vomer. A tentacle over the eye consisting of a flattish stalk with 2—3 cirri at end: length varies from 2—3 in eye. Minute nasal tentacles.

D XXXIV—XXXV, 3—4. Commences above hind margin of preopercle. 1st, 3rd and 4th spines are shortest, subequal, $\frac{1}{2}$ — $\frac{2}{3}$ of eye: 2nd spine $1\frac{1}{4}$ — $1\frac{1}{2}$ times 1st. First three spines widely spaced, membrane deeply notched between 3rd and 4th spines. Remaining spines gradually increase in length, the last spine being 2— $2\frac{1}{4}$ times the first. Membrane scarcely incised. Anterior ray slightly longer than last spine: remaining rays graduated, last ray $\frac{2}{3}$ of first in length, membrane joined to peduncle at base of caudal.

A II, 21—24. 1st spine $\frac{1}{2}$ of eye, 2nd spine $1\frac{1}{2}$ times as long as the first. Rays graduated, first ray 3, last ray 2 in length of head, ends project somewhat beyond membrane.

P. 12, slightly less than head.

V. I. 2—3. Inner (3rd) ray very small when present.

Caudal rounded, $\frac{5}{8}$ of length of head. Peduncle slender, twice as long as deep.

Colour (alive). Mottled grey-green. Seven irregular darker cross bands extending in some cases obliquely on to the base of the dorsal. Narrow dark band at base of caudal. Dark patch on nape. Head spotted. Dark spots on anal, pectoral and caudal, fewer on dorsal. Occasionally irregular reddish blotches on dorsal (males). Reddish tinge on posterior margin of opercle. Sometimes a black spot on membrane between 1st and 2nd dorsal spines.

Locality. Knysna estuary. The types are seven specimens in the Albany Museum collection ranging in length from 55 to 65 mm.

At Knysna this active and shy little fish lives in the sea-grass on the mud-banks of the river and is captured with difficulty.

The species is very close to *acuminatus* C. and V., but differs chiefly in the dorsal fin formula and in the characters of the anterior portion of the spinous dorsal.

Since our diagnosis of the species *acuminatus* is based largely on specimens collected from the Cape Peninsula, described by Gilchrist and Thompson (Ann. S.A. Mus. 1908, vol. VI, pt. 2, p. 124), it is possible that with collection over wider limits, the present species *agilis* may be shown to be a variety or sub-species of *acuminatus*.

It may be noted here that I have found many species of *Clinus* hitherto recorded only from about the Cape Peninsula, occurring regularly along the coast as far east as East London: of these, *cottoides* C. and V., *dorsalis* Blkr, and *superciliosus* Linn. appear to be the most plentiful, while *brachycephalus* C. and V., and *capensis* C. and V. are fairly common, being especially plentiful in the rock-pools at and near East London: *anguillaris* C. and V., *striatus* G. and T., *mus* G. and T., *pavo* G. and T., *brevicristatus* G. and T., *fucorum* G. and T. and *ornatus* G. and T. have also been found.

FAMILY SCORPAENIDAE.

Amblyapistus marleyi Regan.

Regan, Ann. Durban Mus., 1919, vol. II, pt. 4, p. 202. Text fig. 5.

Barnard, Ann. S.A. Mus., 1925, vol. XXI, p. 917.

Depth $2\frac{3}{4}$, length of head 4 in length of body. Eye 3 in head, twice interorbital and almost twice snout. Anterior profile of head almost vertical, concave. Maxilla extends to below the anterior third of the eye. Small villiform teeth on jaws, and in a crescentic band on vomer. Palate edentulous. Nostrils tubular, situated one above the other immediately before the lower margin of the orbit; anterior covered by a plain flap. Gills 4, no slit behind the fourth. Membranes free from the isthmus. Gill-rakers reduced to mere knobs, 7 or 8 on the lower part of the anterior arch.

Preorbital produced backwards into a strong spine, reaching to below the posterior margin of the orbit; a smaller spine below at the base of the larger. Four preopercular spines, the lower three small and blunt, the upper larger, slightly less than the preorbital spine, reaching to the opercular margin. Two spines on the upper margin of the operculum, completely covered by skin.

Lateral line almost straight, tubules 23. Rudimentary cycloid scales, not imbricated, below the skin on the anterior parts of the body, visible externally on the belly and peduncle. Skin smooth and soft.

D XV, 8. 1st spine short, subequal to eye, in advance of anterior margin of orbit. 2nd and 3rd spines longest, subequal, $1\frac{1}{2}$ times length of head: bases of 2nd and 3rd spines apart by an eye diameter, $1\frac{1}{2}$ times as far apart as bases of 3rd and 4th spines. Membranes between 2nd and 3rd spines trapeziform, widening upwards. 6th spine shortest, less than half length of head, last spine $\frac{2}{3}$ of 2nd spine. Membrane of soft dorsal joined to the peduncle at the base of the caudal. 5th ray longest.

A III, 6. Commences below the 14th dorsal spine. Spines graduated, fairly stout. 1st spine shorter than, 3rd spine almost twice, an eye diameter. Membrane of soft anal joined to the

peduncle an eye diameter away from the base of the caudal. 3rd ray longest. P. 12. Rounded, reaches to above the 2nd anal spine. V. I. 5, reaches to the hinder margin of the vent. Caudal rounded, equal to head, rays 12.

Colour. Brown, marbled and spotted with darker. Several dark blotches on the median fins. A light spot below the 9th dorsal spine, just above the lateral line.

A single specimen, 147 mm. in length, from Mr. H. W. Bell Marley, Durban.

Regan's figure (loc. cit) shows neither the more or less trapeziform membrane between the 2nd and 3rd dorsal spines, nor the variation in the basal spacing of the anterior dorsal spines. Regan distinguishes this species from *taenionotus*, C. and V., by the greater length of the preorbital and upper preopercular spines. Barnard (loc. cit) quotes the latter species as having the 2nd and 3rd dorsal spines $\frac{2}{3}$ of the length of the head, and uses this in his key to the South African species of the genus. Day (Fish of India, p. 157, pl. XXXVIII, fig. 5) quotes the 2nd and 3rd dorsal spines of *taenionotus* as being equal to the depth of the body, which his dimensions make to correspond with about $1\frac{1}{4}$ times the length of the head. His figure (loc. cit) on the other hand shows these spines to be $\frac{2}{3}$ of the length of the head. In view of this discrepancy, a re-examination of the type of *taenionotus* appears desirable.

FAMILY SYNANCIIDAE.

Caracanthus zeylonicus Day.

1869. Day. Proc. Zool. Soc., p. 515 (*Amphiprionichthys zeylonicus*).

1878. Day. Fish of India, p. 158. Pl. XXXVIII, fig. 6. (*Micropus zeylonicus*).

Body deep compressed. Dorsal profile elevated, snout steep, blunt. Depth 2, length of head $2\frac{1}{3}$ in length of body. Eye 4 in length of head, $1\frac{1}{2}$ times interorbital width, slightly less than snout. Interorbital space slightly convex, preorbital deep.

Mouth moderate, terminal, somewhat oblique. Small villiform teeth in bands on jaws only. Tongue small, adnate to floor of mouth. Maxilla extends to below anterior third of eye. Nostrils

paired, tubular. Gills 4, no slit behind the fourth. Gill rakers moderate, slender, 13 on lower limb of anterior arch. Gill membranes united to the isthmus.

Pseudobranchiae present. Branchiostegals 5.

Preorbital produced into a laterally projecting spine, which is directed downwards and backwards. Preopercle with five spines, the upper pair small and blunt, the lower pair at the angle enlarged and recurved. A similar stout spine on the interopercle; subopercle with a blunt spine. One moderate and two very small blunt spines on the opercle. A finely serrated ridge runs from above the orbit along the nape.

Arborescent muciferous canals on the head above the preopercle.

D VII, 13. Deeply notched between the spinous and soft portions. 1st spine minute, remaining spines increase in length to the 4th, which is $1\frac{1}{2}$ times the diameter of the eye, then decrease rapidly to the 7th, which is scarcely one third the diameter of the eye. Rays articulated, branched. The first two rays are subequal to the eye, the 3rd to the 9th almost twice as long, while the remainder are shorter than the first ray.

A II, 11. Commences below the middle of the soft dorsal. Spines minute, not externally visible. Rays articulated, branched, subequal to eye. P. 13, rounded, rays articulated. Ventrals thoracic, reduced to a pair of spines scarcely visible.

Caudal rounded, rays articulated. Peduncle stout, deeper than long. Lateral line a continuous tube with 13 single tubules opening dorsally. The L. 1 follows the dorsal profile, and is obsolescent on the anterior part of the caudal peduncle.

Scales absent, papillae on head and body, skin soft and velvety.

Colour. Uniform dark brown, becoming lighter ventrally.

A single specimen, 37 mm. in length, from Great Fish Point.

This appears to be the first record from South Africa.

The species is recorded by Day (loc. cit.) as occurring at Malabar and Ceylon, and its presence so far south is very interesting. Further search will doubtless reveal its presence on the eastern coasts of Africa.

FAMILY TETRODONTIDAE.

Tropidichthys oxylophius n. sp. (Pl. XVI.)

Body deep, moderately compressed. Dorsal profile elevated. Snout concave. Profile strongly concave below chin. Back sharply ridged with apex slightly nearer tip of snout than base of caudal. Nostrils imperforate immediately before the orbit. Interorbital space strongly concave. Moderately prominent ant-orbital ridge. Depth 2, length of head 2 in length of body. Eye $3\frac{1}{2}$ in head, equal to the interorbital width, slightly less than snout. Eye midway between tip of snout and apex of ridge on back. Mouth small: upper teeth projecting beyond lower. Teeth subequal. Small 2-rooted spines which lie flat on the skin on most of head and body. Head spinulose except post-orbital and chin. From above and below centre of orbit, the anterior spines are directed forwards and upwards: the posterior spines are directed mostly backwards. Immediately before the orbit is a larger spine, 3 times as long as the others, directed upwards.

Most of the body is spinulose: no spines on the posterior third of the body, on the peduncle, on a small area behind the pectoral or on the top of the dorsal ridge from the apex to the base of the dorsal fin. On the lower part of the body, the roots of the spines are produced below the skin, giving this area a somewhat reticulate appearance. Skin rugose.

D. 9, rays simple, well back, on posterior third of body.

A. 9, rays simple, commences below posterior margin of base of dorsal. D. and A. subequal in length to diameter of eye.

P. 13, rays simple, equal to snout. Caudal rays 9, branched. $1\frac{1}{2}$ in length of head: subtruncate.

Colour. Uniform dark brown above, uniform light orange below. Slightly lighter ovate mark with light margin and with a short white oblique line below base of dorsal. Extremely fine dark lines running obliquely from eye to snout. Fins light yellow.

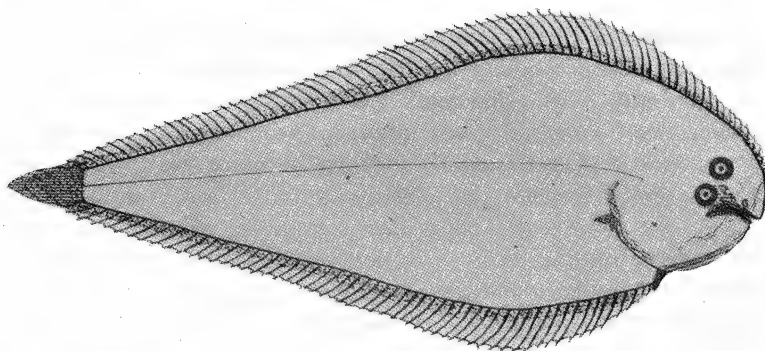
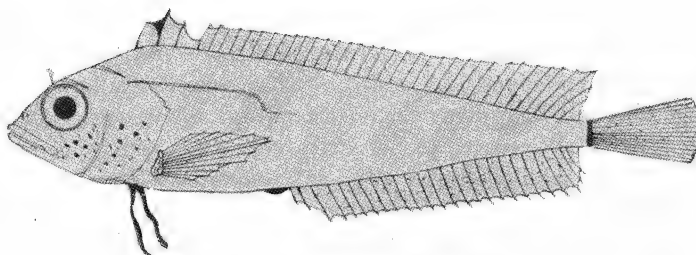
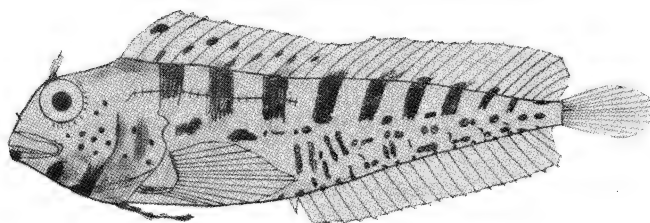
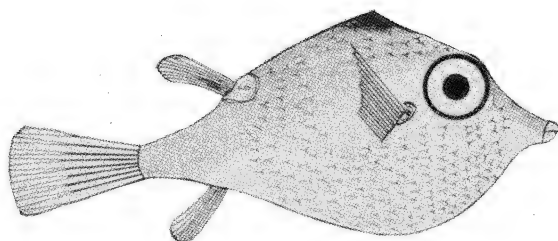
A single specimen 32 mm. in length from Kareiga river mouth, near Port Alfred.

Type in the Albany Museum.

The occurrence of a species of this genus as far west as Port Alfred is rather interesting, no other species having been

recorded south-west of Natal. It may be here noted that I have found many species hitherto regarded as confined to the eastern coasts of Africa extending regularly along the southern coast at least as far west as Knysna.

The author desires to acknowledge gratefully financial assistance received from the Carnegie Grant in aid of Research, through the Research Grant Board of South Africa, which defrayed part of the expenses incurred in the collection of specimens.



Tropidichthys oxylophius n. sp. x $1\frac{3}{4}$.
Blennius fascigula Barnard x $1\frac{9}{10}$.
Clinus agilis n. sp. x $1\frac{1}{2}$.
Synaptura barnardi n. sp. x $1\frac{9}{10}$.

Transactions of the Royal Society of South Africa. Vol. XXI.
Part II. pp. 125–127. Pl. IX. April, 1933.

AN INTERESTING NEW MYCTOPHID FISH FROM SOUTH AFRICA.

By J. L. B. SMITH.

(With Plate IX.)

Family MYCTOPHIDAE.

Genus *Myctophum* Raf.

The subdivision of the numerous polymorphous species of this genus has proved attractive, if somewhat troublesome. Goode and Bean (Ocean. Ich., 1895, p. 71) proposed an elaborate scheme, which has little practical or taxonomic value, since it is based mainly upon features which can have but little natural significance in these fishes. A simple and more natural scheme, based upon the nature and arrangement of the luminous organs, in the form in which it has been suggested by Brauer (Zool. Anz., 1904, vol. xxviii; Wiss. Erg. Deutsch. Tief-See Exp. Valdivia, 1906, vol. xv, pt. 1) has been accepted by most systematists. Brauer considers that there is but a single genus, *Myctophum* Raf., but recognises the four subgenera *Myctophum* Raf. s.s., *Lampanyctus* Bon., *Diaphus* Eig & Eig, and *Lampadena* G. & B.

Since all species hitherto discovered have fallen more or less satisfactorily into one or other of the subgenera, these have acquired a possibly fictitious taxonomic significance, and Parr (Bull. Bing. Oc. Coll., 1928, vol. iii, Art. 3, p. 49) has proposed the raising of the subgenera to full generic rank. This may prove to be of doubtful value, since, not only is our knowledge of these fishes far from complete, but renewed subdivision of *Lampanyctus* and *Diaphus* is almost certain to be proposed.

The remarkable specimen described below does not fall within the limits of any one of these proposed four genera, but would appear to call in question the full generic distinction of *Lampanyctus* from *Diaphus*, since it to some extent bridges the gap between them, but also possesses certain features characteristic of neither. This would appear to involve either renewed subdivision of *Diaphus*, or the institution of yet another subgenus of the single wide genus *Myctophum*. The latter alternative appears preferable, and is here adopted.

Nasolychnus, new subgenus.

No luminous plates on peduncle. Luminous scales present or absent. Antorbital organs enlarged, probably always continuous above and below nostrils. Photophores circular, without dividing septum; five, or more or less than five, precaudal. The two infrapectoral organs probably never in line with the first pectoral organ. Spongy, probably luminous, tissue between the ventral bases, not corresponding with the scale pockets. Maxilla extending well behind eye, posteriorly dilated.

This subgenus is closely related to *Diaphus*, from which, however, it differs in several features.

Myctophum (Nasolychnus) florentii n. sp.

Body elongate, moderately compressed, width 1.7 in depth. Dorsal profile even, snout blunt, almost vertical before eye. Depth 5.1, length of head 3.9 in length of body. Eye 4 in head, 1.8 times snout, 1.2 in interorbital width, and 2.6 in the postorbital part of the head. Strong median ridge on snout. Preopercle margin very oblique. Mouth large, maxilla extends 1.7 times eye diameter behind eye, posteriorly dilated. Minute teeth in both jaws and on palatines, pterygoids, and tongue: a few rudimentary teeth on sides of vomer. Gill rakers 25, slender, 2 in eye.

D 19, commences above the ventrals, 5th ray longest, 1.7 in head, last ray 4 in head. Edge of fin straight. Base of dorsal as long as head. Adipose dorsal just behind end of anal base.

A 19, commences below the 14th dorsal ray, 5th ray longest, 2.1 in head, last ray 6 in head, edge of fin gently concave. Base of anal 1.25 in length of head.

P 12, inserted in lower third of side, 3.3 in head, does not reach to ventral base. V 9, inserted twice as far from base of caudal as from centre of eye, 1.7 in head, reaches to vent. Caudal deeply forked, densely scaled.

Photophores circular, without dividing septum. (Brauer's terminology is here employed.) PLO much nearer lateral line than pectoral base. Upper PVO above pectoral base, lower behind upper. The PLO and the two PVO form an almost straight series with the 2nd (? 3rd, *vide infra*) PO. 5 PO, first twice as far from second as remainder from one another (there may have been 6 PO, since on each side the scale behind the anterior PO is missing, see figure). VLO twice as far from ventral base as from lateral line. 5 VO in a gently curved series, 3rd highest. 4 SAO, the anterior three forming a gently curved oblique series with the posterior VO. Upper SAO in lateral line, forming a straight oblique series with posterior (4th) SAO and first antero-AO. 7 + 9 AO. 2 Pol, upper almost in lateral line, in a straight oblique series with last antero-AO. On one side 4 + 1 Pre,

An Interesting New Myctophid Fish from South Africa. 127

separate from AO, last separate, highest, just below end of lateral line : on the other side there are 1 + 2 + 1 Prc, the posterior as before, the remainder being arranged 1 + 2, with two rudiments between. Branchiostegal organs 3, obscure. On one side 3 opercular organs, upper small ; lower two large, contiguous or partly fused, expanded ventrally. Upper organ absent on other side. Antorbital organs conspicuously enlarged, continuous above and below nostrils. A cuneiform patch of white, probably luminous tissue between ventral bases, about half eye diameter in length, not covered by scales and not corresponding with the scaling. No luminous plates. No true luminous scales, but most scales on the body and the top of the head with a central irregularly shaped light patch, probably luminous. Dorsal sheath scales mostly with central luminous patch. Edges of fontanel white, probably luminous.

Scales cycloid, l.l. tubes 46, l.l. scales not enlarged, l.tr. $\frac{4}{5}$ (from origin of dorsal), about 15 predorsal, 4-5 scales on cheek.

Colour.—Uniform brown, antorbitals bright silvery. Photophores opalescent with black tissue before and behind. Proximal third of ventrals light.

Length.—136 mm.

Type.—A ripe female, in the Albany Museum.

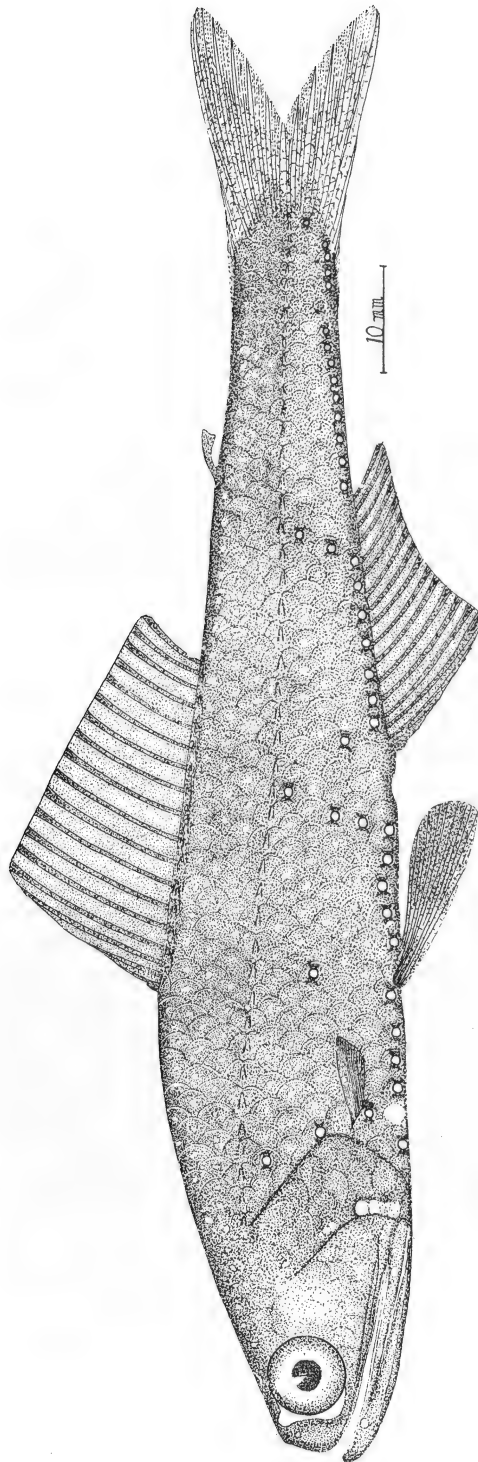
Locality.—Bushman's River, near Port Alfred, found on the shore by Miss Florence Hewitt.

The photophores on the cheek, and the Prc, as indicated above, are not the same on both sides. The 4 + 1 Prc is evidently normal, while the 1 + 2 + 1 on the right side is most probably not, since there are two rudimentary or defective organs between the first and the second.

It is an open question whether the photophores here described as the posterior (4th) SAO, and as the lower Pol, might not be regarded as the first and the ninth antero-AO respectively, elevated above the rest. Since the remaining AO are in two regular horizontal series, it appears preferable to regard these others as belonging to the SAO and to the Pol respectively.

Considering that this remarkably large specimen was cast up by waves, although some of the scales are missing, it is in a remarkable state of preservation, so as to lead one to conclude that even a somewhat fragile dividing septum, such as is present in *Diaphus*, would still be intact in some of the photophores, had it originally been present.

The eggs are about 0.6 mm. in diameter, and are certainly exceedingly numerous.



Myctophum (Nasolichnus) florentii n. sp.

Transactions of the Royal Society of South Africa. Vol. XXI.
Part II. pp. 129–150. Pls. X–XII. April, 1933.

THE SOUTH AFRICAN SPECIES OF THE GENUS
HEMIRHAMPHUS CUV.

By J. L. B. SMITH.

Genus *Hemirhamphus* Cuv.

(With Plates X–XII and one Text-figure.)

Cuvier, Reg. Anim., 1817, ii, p. 186.

Body elongate, subcylindrical or compressed. Lower jaw produced into a long beak, with teeth only in the part opposite the edges of the premaxillae. A cutaneous fringe from corner of mouth on each side to apex of beak: a median bilobed sac expanded at origin below the chin, tapering forward to below tip of beak. Premaxillae, fused with maxillae, produced, forming a flattened triangular upper jaw, naked or scaly. Teeth small, conical, bi- or tricuspid, in bands in both jaws. Ventrals abdominal, nearer to base of caudal than tip of upper jaw. Pectorals inserted above middle of side, not longer than head. Dorsal originates far back, much nearer base of caudal than base of pectoral. Caudal forked or emarginate, the lower lobe longer. Scales cycloid, moderate or large, deciduous. Lateral line ventro-lateral in position, commences on chest, ends before base of caudal: a superior branch to pectoral base. Lateral line tubes with few or many inferior tubules. Gill-openings wide, gill-rakers numerous, well developed. Third upper pharyngeals fused. Air-bladder simple or cellular.

Subgenera of *Hemirhamphus* Cuv. have several times been proposed. Gill (Proc. Ac. Nat. Sci. Phil., 1859, p. 131) instituted the genus *Hyporhamphus* for species with ventrals inserted nearer head than caudal base, and air-bladder simple. Fowler ("Fishes Oceania," Mem. B. P. Bishop Mus., 1928, x, p. 75) has proposed the subgenus *Rhynchorhamphus* for species with triangular part of upper jaw longer than wide, beak very long, and ventrals nearer caudal base than head. To *Hemirhamphus* (s.s.) are then assigned species with ventrals nearer caudal base than head, upper jaw wider than long, and air-bladder cellular.

The position of the ventrals appears to be a most unsatisfactory feature on which to found an allied genus, or even a subgenus of *Hemirhamphus*,

for in the species we find regular variation of this position from midway between caudal base and tip of pectoral to midway between caudal base and eye, several species having the ventrals inserted exactly midway between caudal base and head. The shape of the upper jaw and the length of the beak have little to recommend them as features for a similar purpose, since it is shown in the present work that these vary considerably with the growth of the fish.

The South African species alone show the doubtful utility of the subgenera as defined above: *delagoae* Brnrd. has the simple air-bladder of *Hyporhamphus*, but the ventrals inserted as in *Hemirhamphus*; *knysnaensis* n. sp. has the ventrals inserted midway between caudal base and head, thus falling midway between *Hyporhamphus* and *Hemirhamphus*, the triangular part of the upper jaw in adults longer than wide, as in *Rhynchorhamphus*, but the beak is not very long, while the juvenile stages have the upper jaw wider than long, or as wide as long, according to the stage of growth.

I cannot therefore accept the present forms in which the above subgenera appear.

Generic subdivision may more sharply and with greater justification be based upon other features, such as the presence or absence of scales on the triangular part of the upper jaw, which is constant at all stages, or upon the nature of the growth changes observed during the early and mid-juvenile stages. As will be seen below, these stadia of *far* Forsk. show primary increase in the relative length of the ventrals, followed by recession, together with very considerable changes in the shape of the dorsal fin. In *knysnaensis* n. sp., on the other hand, no such changes with growth are observed; further, the triangular part of the upper jaw of *knysnaensis* is scaly, but naked in *far*. These two species may be regarded as subgenerically distinct, but until complete information on these points is available it would appear inadvisable to subdivide *Hemirhamphus* Cuv., and I do not here propose to attempt such a step, since it would serve no useful purpose as far as the South African species are concerned.

The South African species have received somewhat scant attention, and stood in need of critical revision. Two new species, *knysnaensis* and *improvisus*, are here described, and *balinensis* Blkr., which has not previously been recorded from our region, is now included.

Two species, *marginatus* Forsk. and *schlegeli* Blkr., which have been recorded from the neighbourhood of, but not strictly within the limits of, our region (after Barnard, Ann. S.A. Mus., 1925, xxi, p. 4, south of Mossamedes, west coast, and of Mozambique, east coast), are included, since with more intensive collection they are sure to be discovered here.

In South Africa the species of *Hemirhamphus* are generally known as

The South African Species of the Genus Hemirhamphus Cuv. 131

"Naald-vis" or "Needle-fish," also as "Half-beaks." They are of little or no economic significance, most of them being rather small and seldom taken in number. *far* is occasionally taken in moderate numbers by dragnets in the summer months, but is not generally in demand as a food-fish.

Terms employed in the Descriptions.

Since the beak and the caudal fin of preserved specimens are frequently damaged, the dimensional relationships are not here stated in total length only. The following limits are employed:—

Length of Body.—Measured from caudal base (v.i.) to tip of triangular part of upper jaw.

Length of Head.—Measured from hind margin of operculum to tip of upper jaw.

Length of Beak.—Measured from below tip of upper jaw to apex of beak.

Base of Caudal.—This is taken as the base of the mid-caudal rays, generally obscured by scales.

Lateral Rows of Scales.—Counted from above the hind margin of the operculum to caudal base, not including scales extending on to the caudal rays.

Lateral Line.—Figures indicate the number of scales bearing tubules, and the count is taken as follows, e.g. $\frac{4}{2+27+28}$, which indicates 4 from pectoral base down to junction, 2 from chest to junction, 27 from junction to ventral base, and 28 posteriorly from ventral base.

Key to the South African Species.

- A. Upper jaw naked. Ventrals nearer base of caudal than base of pectoral.
 1. Black blotches on side. Body subquadrangular in cross-section, not very compressed *far*.
 2. No blotches on side. Body fairly compressed *marginatus*.
- B. Upper jaw scaly. Ventrals inserted midway between base of caudal and base of pectoral, or nearer the latter.
 1. Mid-caudal rays not longer than eye. Caudal deeply forked. Dorsal scaly.
 - a. 50–52 lateral rows of scales.
Pectoral and ventral not scaly *dussumieri*.
 - b. 58–61 lateral rows of scales.
Pectoral and ventral scaly.
 - i. Beak 6·3 in total length. Preorbital 1·3 times longer than deep, not as long as eye *delagoae*.
 - ii. Beak 4–5 in total length. Preorbital 1·8–1·9 times longer than deep, as long as eye *balinensis*.

132 *Transactions of the Royal Society of South Africa.*

2. Mid-caudal rays longer than eye. Caudal emarginate. Dorsal not scaly.
 - a. Ventrals nearer hind margin of preopercle than base of caudal. Upper jaw wider than long, with 3-4 transverse series of scales, middle series over median ridge *improvisus*.
 - b. Ventrals nearer base of caudal than hind margin of preopercle. Upper jaw not wider than long, with 2 transverse series of scales, median ridge not covered by scales.
 - i. Upper jaw longer than wide. 55-58 lateral rows of scales. South and east coasts *knysnaensis*.
 - ii. Upper jaw as wide as long. 50-53 lateral rows of scales. West coast *schlegeli*.

Hemirhamphus far Forsk.

(Plate XII, fig. 1.)

1853. Bleeker, Nat. Tijdschr. Ned. Ind., v, p. 89 (*fasciatus*).
 1866. Bleeker, Atlas Ich., vi, p. 54, pl. vi, fig. 3.
 1878. Day, Fishes of India, p. 516, pl. cxx, fig. 3.
 1908. Gilchrist, Ann. S.A. Mus., vi, p. 266 (*commersoni*).
 1913. Weber, Siboga-Exp. Fische, p. 131 (*fasciatus*).
 1922. Weber and de Beaufort, Fishes Indo-Aus. Arch., iv, p. 157, fig. 55
 and p. 158 (*marginatus*, juvenile = *fasciatus* Blkr.).
 1925. Barnard, Ann. S.A. Mus., xxi, p. 262.

Adults.

Body elongate, robust, width 1.3-1.5 in depth. Sides scarcely convex, form, with almost flat ventral surface, a right-angled ventro-lateral edge. Depth 6-8, length of head 4.3-5.3, in length of body. Lower jaw 3-3.5 in body, 4.4-5 in total length. Eye 4-4.4 in head, 1.2-1.5 in snout, 1.6-1.8 in postorbital part of head, and 1.1-1.5 in interorbital width. Width of snout before eyes $\frac{7}{8}$ of its length. Head slightly depressed, interorbital gently convex, with 2 shallow longitudinal grooves. Top of head scaly to above nostrils. A slight medio-longitudinal ridge on the triangular part of the upper jaw, which latter is thick and fleshy, scaleless, and 1.3-1.9 times as wide as long. Width of lower jaw below tip of snout almost an eye diameter. Fairly stout tricuspid teeth in 3-4 rows in lower and 2-3 rows in upper jaw. Beak stout, cutaneous fringes about half the width of the beak: subgular sac prominent. Preorbital 1.3 times deeper than long, depth about half-eye diameter; covered by a single scale. Opercle with one large and two smaller scales. A single series of scales on the cheek, extending forward to below the corner of the mouth.

Gill-rakers 20-23, fairly stout, 3.5 in gill-filaments which are 1.5 in eye. Branchiostegals 12-13, membrane and mentum scaleless.

The South African Species of the Genus Hemirhamphus Cuv. 133

D 13-14, arises twice as far from base of caudal as from base of ventral. Anterior rays elevated, 3rd longest 1.7-1.9 in head, remainder decrease rapidly to the penultimate, which is about 9 in head, the fin having a deeply concave edge. The last ray is elongate, about 5 in head, with hinder branch free from membrane. Anterior fourth of fin densely scaled.

A 10-13, commences below the 6th or 7th dorsal ray. Anterior rays elevated, 3rd longest 2.5 in head, remainder decrease to the penultimate, which is about 9 in head, the fin having a gently concave edge. The hinder branch of the last ray is slightly longer than the preceding rays. Anterior third of fin densely scaled. Base of anal 1.6-2 in length of base of dorsal (rarely more than 1.8).

P 12, 1.3-1.7 in head, scaleless.

V 6, scaleless, 2.2-2.8 in head, inserted midway between base of caudal and almost the tip to distal fourth of pectoral. 1st and last rays longest, subequal, inner four rays graduated, shorter than 1st and last; last ray about 1.3 times the length of the penultimate.

Caudal deeply forked, upper lobe shorter, 1.3-1.4 in length of lower; mid rays shorter than or equal to eye.

Peduncle fairly robust.

Air-bladder cellular.

Scales.—Lateral rows 55-58, l.l. $\frac{3}{3+26-27+21-22}$, predorsal 37-39, 6-7 between dorsal and lateral line. Lateral line tubes highly arborescent ventrally (Plate X, A), more elaborated in anterior scales.

Colour.—Blue-green above, silvery below, dorsal scales light, with dark margin; opercle bronzy. Beak and membranes black, tip of beak red. A silvery-plumbeous stripe with blue upper margin from base of caudal along side curving gently over pectoral base and ending on shoulder: widest midway. 4-10 more or less distinct dusky blotches on side chiefly above lateral stripe. Dorsal, most of caudal, anterior part of anal, and ventrals, except last ray, dusky. Pectorals light. Ripe fishes usually have reddish blotches on the abdomen.

Length.—200-533 mm.

Locality.—Eastwards from False Bay, entering tidal rivers from Breede River, Port Beaufort to the Zambesi River, Rhodesia, occurring even in the Mazoe River, a tributary of the Zambesi, in fresh water miles from the coast.

Distribution.—Almost circumtropical.

Juveniles.

Very young specimens show considerable divergence from the adult form chiefly in the size and shape of the fins and of the jaws. The following

table indicates certain of the features of change with the growth of the fish:—

Total length (mm.) . .	12	18	24	33	53	60	72	115	135	195	295	533
Depth in body . . .	>10	>10	10	10	9	9	9	8.4	8	8	7	6.5
Head in body . . .	ca. 4	ca. 4	4.5	4.5	4.5	4.5	4.8	4.8	4.8	4.3	4.5	4.9
Beak in total length .	None	ca. 20	9	6	5	4.5	4.8	4.4	4.4	4.3	4.6	5.0
Triangular upper jaw, wide as long . . .	..	ca. 7	ca. 7	ca. 7	ca. 5	ca. 5	4	2.5	2.5	2.0	1.4	1.4
Eye in head . . .	ca. 2	ca. 2.5	3	3	3.2	3.3	3.3	3.5	3.7	4	4	4.3
Eye in snout . . .	..	ca. 0.4	ca. 0.5	0.6	0.7	0.8	0.8	1.1	1.1	1.1	1.4	1.5
Eye in postorbital part head . . .	..	ca. 1.3	1.5	1.6	1.5	1.7	1.7	1.7	1.7	1.7	1.7	1.8
Pectoral in head . . .	ca. 1.5	ca. 1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.6	1.4	1.7
Ventral in head . . .	ca. 4	ca. 3	2.0	1.8	1.6	1.6	1.7	1.5	1.6	2.0	2.4	2.8
Upper caudal lobe in lower . . .	ca. 1.0	1.1	1.2	1.6	1.8	1.6	1.6	1.7	1.5	1.4	1.4	1.3
Shortest caudal rays in eye . . .	ca. 0.5	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.1	1.1

Features which do not change appreciably with growth are the shape of the anal fin and the relative size and shape of the pectorals.

The Mouth and Jaws.

There is no prolongation of the lower jaw in fishes not exceeding 15 mm. in length: the adult proportions are attained when the total length is 50–60 mm. Fishes 100–200 mm. in length have relatively longer beaks than larger examples. (See above table.) The mouth is at first almost vertical and changes to nearly horizontal with the growth of the upper jaw, which commences only when the lower jaw is fully prolonged. Very young fishes have a single row of teeth, many of which are conical, though tricuspid teeth are observed at all stages: the number of rows increases with age.

Ventral Fins.

In very small fishes the ventrals are inserted midway between the base of the caudal and the middle to distal third of the pectoral. The point of insertion moves somewhat towards the caudal with growth of the fish. The ventrals are fairly small in the youngest stadia, increase in relative length until the fish is about 100 mm. in length, and thereafter decrease. In specimens 50–120 mm. in length the ventrals reach the base of the anal or beyond. The shape of the fin also undergoes modification: in fishes not longer than 60 mm. they resemble in shape that of the ventrals in an adult of the Exocoetid genus *Cypsilurus* Swnsn.: the 3rd ray longest, 1st shortest, 6th intermediate between 1st and 3rd, remainder graduated: the distal third of the fin being subacutely triangular in shape. With

The South African Species of the Genus Hemirhamphus Cuv. 135

growth of the fish, the 1st, 5th, and 6th rays increase in relative length, while the 3rd becomes shorter, so that when the fish is about 200 mm. in length, the 5th ray is longest, the 4th and 6th slightly shorter, subequal, 1st ray shortest. Further growth results in the change to the adult form in which the 1st and 6th rays are longest, subequal, the 2nd ray shortest, edge of fin concave.

Dorsal Fin.

When the length of the fish does not exceed 50 mm. the posterior dorsal rays are about twice as long as the anterior, and when laid back reach on to the caudal: the edge of the fin is straight. The relative length of the rays changes with growth: at about 100 mm. total length the anterior and posterior rays are subequal, the mid rays shorter, the anterior margin of the fin being concave: at about 150 mm. the anterior rays are 1.5 times the posterior, and the anterior part of the fin has the subfalcate shape of that of the adult. The posterior rays laid back no longer reach to the caudal. When the fish is about 200 mm. in length the shape of the fin approximates to that of the adult.

Coloration.

Very small fishes (35 mm.) are dusky green, with dendritic specks uniformly distributed over the body, approximating anteriorly to the scaling. Beyond this stage faint cross-bars appear, and with growth increase in density. In fishes exceeding 50 mm. in length there are 10 cross-bars on the body, one across the base of the caudal rays and a wide blotch over the distal portion of the lower caudal lobe: the caudal bars and the ventral portion of the bars on the side are rust-red in colour. The cross-bars on the body are prominent in fishes of 60–200 mm. in length, the ventral portion, and the caudal bars fading with growth.

In all but the smallest specimens the ventrals are black, the pigmentation retreating somewhat distally with growth, while the first ray becomes light. The dorsal and anal are at first almost wholly dark, the pigmented area retreating distally with growth, until in larger specimens the anterior part of each fin and a broad marginal band only are dark. The pectorals are uniformly unpigmented. The lateral stripe is not visible in specimens of less than 30 mm. total length. Fishes 50–100 mm. in length frequently have dark blue spots on the head. Beak and membranes black: tip of beak red in advance of mid-juvenile stage.

H. fasciatus Blkr. is undoubtedly the juvenile form of *far*. Weber and de Beaufort's diagnosis (*loc. cit.*) of *fasciatus* as juvenile *marginatus* Forsk. was evidently based upon the relative lengths of the bases of the anal and dorsal fins, which these authors state to be in *far* base anal 2 in base

dorsal, and 1.5–1.7 in *marginatus*. In our specimens of *far*, the base of the anal is usually 1.6–1.8 in the length of the base of the dorsal, occasional specimens showing 1.8–2. Our specimens show also further divergence from the usual diagnosis of *far*: the last ray of the ventrals and of the dorsal are elongate, longer than the penultimate; the number of scales in lateral series and the number of predorsal scales are greater: the anterior portion of the dorsal is more subfalcate in shape, while the body is not as deep nor the head as long as in specimens from other areas. It may be noted that the figures of Day (*loc. cit.*) and of Weber and de Beaufort (*loc. cit.*) are not strictly in accordance with the respective descriptions, while none of our specimens have the markedly fusiform body indicated in these figures, but are deepest across the middle of the pectorals, even fully ripe fishes.

I have examined several specimens from the Indo-Pacific and find that they have the base of the anal 1.8–2 in length of dorsal base and 51–55 lateral rows of scales. From the nature of the other features mentioned above, it would appear that most descriptions of *far* have been based upon old, preserved, and possibly damaged specimens.

Breeding Habits, Etc.

In the Knysna and neighbouring rivers specimens of *far* are first observed early in October, all ripe adults. The numbers increase rapidly, attaining a maximum in December and January. Ripe and spent adults are found until March, after which only a very occasional specimen is encountered, and none are present after the end of March. The young appear in November, become exceedingly abundant by January, and disappear entirely by March.

The eggs of *far* are demersal, 2.95–3.1 mm. in diameter, translucent, and provided with numerous glutinous filaments not longer than the diameter of the egg. The larger females produce about 12,000 eggs per season at Knysna. The breeding fishes, which appear to travel even beyond the tidal area in the rivers, congregate in shallow water over grassy banks, where two or more may frequently be seen slowly circling over a restricted area. In one case, two specimens so engaged were captured, and on examination, one, the larger, proved to be a ripe female, and the other a ripe male.

H. far may also be taken by allowing a fine line, baited with a small "shrimp" or "mud-prawn," to drift in the surface of the water: these larger specimens are exceedingly lively and provide most excellent sport on light tackle. The flesh is of fine texture and flavour, but is not generally esteemed on account of the presence of numerous fine bones.

The South African Species of the Genus Hemirhamphus Cuv. 137*Hemirhamphus marginatus* Forsk.

1775. Forskal, Descr. Anim., p. 67.

1922. Weber and de Beaufort, Fishes Indo-Aus. Archip., iv, p. 157.

1928. Fowler, "Fishes Oceania," Mem. B. P. Bishop Mus., x, p. 78 (record only).

Body fairly compressed, width 2-3 in depth. Depth 5.3-6.5, length of head 3.7-4.2, in length of body. Lower jaw 3.3-3.5 in body, 4.5-5.1 in total length. Eye 3.8 in head, 1.3 in snout, 1.4-1.7 in postorbital part of head, and equal to or slightly greater than interorbital width. Head slightly depressed, interorbital gently convex, with 2 shallow longitudinal grooves. A slight medio-longitudinal ridge on the triangular part of the upper jaw, which latter is more convex above than in other species, and 1.3-1.5 times as wide as long, scaleless. Width of lower jaw below tip of snout slightly more than half an eye diameter. Tricuspid teeth in 2 rows in upper and 3-4 rows in lower jaw. Beak slender. Preorbital 1.2 times longer than deep, $\frac{3}{4}$ eye diameter in length. Single series of scales on cheek.

Gill-rakers 23, 2.3 in gill-filaments, which are 1.6 in eye.

D 13-14, arises 1.5-2 times as far from base of caudal as from base of ventral. Anterior rays elevated, about 1.9 in head, edge of fin deeply concave. Densely scaled anteriorly.

A 10-13, commences below the 6th dorsal ray. Anterior rays elevated, about 3 in head, edge of fin concave, last ray elongate. Scaly anteriorly. Base of anal 1.5-1.7 in length of base of dorsal.

P 11, 1.2-1.3 in head, scaleless.

V 6, scaleless, 2.6 in head, inserted midway between base of caudal and distal third of pectoral, first and last rays longest, subequal.

Caudal deeply forked, upper lobe shorter, 1.3 in length of lower; mid rays shorter than eye. Air-bladder at least partly cellular.

Scales.—Lateral rows 53-56, l.l. $\frac{3-4}{2-3+27-29+21-24}$, predorsal 34-38, 6 between dorsal and lateral line. Lateral line tubes arborescent ventrally. Arborescent muciferous canals on scales of head in some specimens.

Colour.—Blue-green above, silvery below. Plumbeous lateral stripe curving up over pectoral base. Beak and membranes black. Dorsal dusky, dark anteriorly. Caudal dusky, darker marginally. Pectorals and ventrals light.

Length.—Up to 350 mm.

Locality.—Gold Coast.

Distribution.—Almost circumtropical.

This species has not yet been recorded from within our area, but is

sure to be discovered on our eastern coast. I have examined specimens from the Indo-Pacific, and one specimen, loaned by the British Museum, from Accra. It is very closely related to *far*, from which it differs in the absence of the lateral blotches as well as in the highly compressed body, in the narrower interorbital, and in the fairly convex upper surface of the upper jaw.

Hemirhamphus dussumieri C. and V.

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., xix, p. 33.

1925. Fowler, Proc. Ac. Nat. Sci. Phil., lxxvii, p. 203.

1925. Barnard, Ann. S.A. Mus., xxi, p. 263.

Body elongate, subcylindrical. Depth 9, head 4.5, in length of body. (Lower jaw 4-5.5 in body, 5-6.3 in total length.) Eye 4 in head, 1.5 in snout, 1.5 in postorbital part of the head, slightly less than interorbital width (slightly less than or equal to interorbital). Width of snout before eye $\frac{3}{4}$ of its length. Head moderately depressed, interorbital flat, scaled, three transverse series. A medio-longitudinal ridge on triangular part of upper jaw, which is 1.3 times as wide as long, scaly, 5 longitudinal and 3 transverse series of scales. Width of lower jaw below tip of snout $\frac{5}{8}$ of eye diameter. Small tricuspid teeth in fairly wide bands in both jaws. Beak stout, cutaneous fringes narrow, subgular sac small. Preorbital 1.5 times longer than deep, covered by a single scale. Two series of scales on cheek, scaling extends forward to below tip of snout. A single line of pores on chin. Opercle naked, scales evidently fallen off.

Gill-rakers 28, 3 in gill-filaments, which are 1.5 in eye.

D 15 (14-16), commences slightly nearer base of ventral than base of caudal. Anterior rays elevated, almost 3 in head; remainder decrease, edge of fin concave. Fin scaly.

A 15 (13-15), commences below the third dorsal ray. Similar in shape to dorsal. Fin scaly. Base of anal slightly less than base of dorsal.

P 11, 2 in head, not scaly.

V 6, not scaly, 3.3 in head, inserted midway between base of caudal and centre of opercle.

Caudal deeply forked, lower lobe longer. Mid rays $\frac{3}{4}$ of eye diameter. Air-bladder simple.

Scales.—Lateral rows 52 (50-52), lateral line $\frac{3}{3+22+27}$, predorsal 33 (32-34), 6 scales between dorsal and lateral line.

Colour (preserved).—Light brown, evidently bright green-blue above, silvery below. Fins light. Numerous close-set blue spots on head and snout and in a mid dorsal line to the origin of the dorsal.

Length.—Up to 300 mm.

The South African Species of the Genus Hemirhamphus Cuv. 139

Distribution.—East coast of Africa, Indo-Pacific.

I have seen only one specimen of this species, from Aden, lent by the British Museum.

It would appear that a revision of this species is highly necessary, for not only do descriptions vary rather widely, but authors differ in the nominal species admitted as synonyms.

Day (Fishes of India, 1878, p. 515) includes *dussumieri*, described by Bleeker (Atl. Ich., 1866, vi, p. 56) in the synonymy of *reynaldi* C. & V. This is accepted by Weber and de Beaufort (Fishes Indo-Aus. Arch., 1922, iv, p. 155), who consider both synonyms of *dussumieri* C. & V., and who somewhat arbitrarily admit *erythrorinchus* le Sueur to the synonymy of *dussumieri* C. & V., but do not give expression to the admitted priority of the former name. Fowler ("Fishes Oceania," suppl., 1931, p. 319) considers *dussumieri* C. & V. a synonym of *erythrorinchus* le S.

Klunzinger ("Fische Rothe Meer," Verh. Zoo. Bot. Ges. Wien, 1871, p. 584) gives a description of *dussumieri* C. & V. which does not agree with many other descriptions of this species, as indicated by Day (*loc. cit.*), whereas Weber and de Beaufort accept it as *dussumieri* C. & V.

In my opinion, many specimens of *erythrorinchus* le S. have been described as *dussumieri* C. & V., but it would appear that this latter species may well be maintained as distinct from the former, provisionally differentiated by the presence of scales on the dorsal and anal fins, postorbital part of head more than 1.4 times eye, mid-caudal rays less than eye, and ventrals nearer head than caudal base.

Fowler's Delagoa Bay specimens (*loc. cit.*) are most probably *dussumieri* C. & V. (as here defined), although this author states the relation of neither the postorbital part of the head, nor of the mid-caudal rays, to the eye, while his specimens have D 13, and only 18 gill-rakers on the lower part of the anterior arch.

In so far as I am able to determine, *erythrorinchus* le S. does not fall within or near our area.

Hemirhamphus delagoae Brnrd.

(Plate XII, fig. 2.)

1925. Barnard, Ann. S.A. Mus., xxi, pl. x, fig. 6.

Body elongate, slightly compressed, sides scarcely convex. Width 1.25 in depth.

Depth 10, length of head 4.8, in length of body. Lower jaw 4.9 in body, 6.3 in total length.

Eye 3.8 in head, 1.4 in snout and in postorbital part of the head, slightly greater than the interorbital width. Width of snout before the eyes

about $\frac{2}{3}$ of its length. Head depressed, indications of scales on occiput. Slight medio-longitudinal ridge on triangular part of upper jaw, which latter is twice as wide as long, scaly, 4-5 longitudinal and 3-4 transverse series of scales. Width of lower jaw below tip of snout about $\frac{2}{3}$ of eye diameter.

Uni-, bi-, and tricuspid teeth present in anteriorly tapering bands, in 3-5 rows in each jaw, inner teeth mostly tricuspid, outer mostly unicuspid. Beak stout, cutaneous fringes $\frac{1}{3}$ - $\frac{1}{4}$ as wide as beak; subgular sac moderate. Preorbital 1.3 times longer than deep, length 1.6 in eye, covered by a single scale with 2 central-branched pores. Three large scales with branched pores on opercle. 3-4 series of scales on cheek, scaling extends forwards to below the tip of the snout.

Gill-rakers 24, moderately slender, 1.3 in gill-filaments which are 3 in eye. Branchiostegals 12, membrane scaly. Mentum broad and densely scaled to symphysis, about 20 longitudinal and 4 transverse series of scales.

D 15, arises considerably in advance of midway between bases of caudal and ventral. Anterior rays elevated, 2.2 in head; remainder decrease, edge of fin concave. Densely scaled, heaviest anteriorly.

A 16, commences below the 2nd dorsal ray. Shape similar to dorsal, anterior rays about 2.5 in head. Densely scaled. Base of anal 1.25 in base of dorsal.

P 12, 1.8 in head. Base densely scaled, scaling extends over half the length of the fin.

V 6, scaled, densely on basal portion, length 3 in head. Inserted midway between base of caudal and base of pectoral. Anterior rays longest, last slightly longer than penultimate. Edge of fin concave. Caudal deeply forked, upper lobe 1.3 in lower. Mid rays slightly less than eye. Peduncle fairly stout.

Air-bladder simple.

Scales.—Lateral rows 61, l.l. $\frac{4}{2+27+28}$, predorsal 40, 6 rows between dorsal and lateral line. Lateral line tubes with numerous inferior tubules (Plate X, C).

Colour.—Greenish-blue above, silvery below. Nape, occiput, snout, and opercle dusky. Lower jaw and membranes black, tip of beak red. A narrow plumbeous lateral stripe from the base of the caudal to axil of pectoral, widest below origin of dorsal. Anterior dorsal rays dusky, remaining fins light.

Length.—295 mm.

Locality.—Delagoa Bay.

Type.—In the South African Museum (No. 12303).

The South African Species of the Genus Hemirhamphus Cuv. 141

The original description is inaccurate in many particulars, nor does the figure agree with the description.

This species is very closely related to *balinensis* Blkr., but differs in the shorter beak, in the size and shape of the preorbital, and in the much wider upper jaw. The eye is relatively larger in *delagoae* than in *balinensis*. It is an open question whether these differences alone justify the maintenance of *delagoae* as distinct from *balinensis*, the shorter beak of the former species being the only difference of note.

Fowler (Ann. Nat. Mus., vi, pt. 2, p. 250) considers that *delagoae* is identical with *unifasciatus* Ranz. The errors in the original description have evidently misled Fowler, for *delagoae* is well differentiated from *unifasciatus* by the position of the ventrals alone.

Hemirhamphus balinensis Blkr.

1858. Bleeker, Nat. Tijdschr. Ned. Ind., xvii, p. 170.

1922. Weber and de Beaufort, Fishes Indo-Aus. Arch., iv, p. 152.

Body moderately compressed, width about 2 in depth. Depth 9-10, length of head 4.5, in length of body. Lower jaw 3.4 in body, 4.8-4.9 in total length. Eye 4.5 in head, 1.5-1.6 in snout, 1.6-1.9 in postorbital part of head, equal to the interorbital width. Width of snout before the eyes $\frac{2}{3}$ of its length. Head depressed, occiput scaly. Slight medio-longitudinal ridge on triangular part of upper jaw, which latter is 1.1-1.3 times as broad as long, scaly, 4-5 longitudinal and 3-4 transverse series of scales. Bi- and tricuspid teeth present in anteriorly tapering bands, in 3-4 rows in each jaw. Beak slender, cutaneous fringes narrow, subgular sac moderate. Preorbital 1.8-1.9 times as long as deep, as long as eye, covered by a single scale with 2 central pores. 2-3 series of scales on cheek, scaling extends forwards along sides of beak almost half-length of beak. Gill-rakers 22-26, slender, 2 in gill-filaments, which are about 2 in eye. Branchiostegals 12, membrane scaly. Mentum moderate, densely scaled to symphysis, about 20 longitudinal and 4 transverse series of scales.

D 15-16, arises considerably in advance of midway between bases of caudal and ventral. Anterior rays elevated, about 3 in head, remainder decrease to the penultimate, last ray elongate. Edge of fin concave. Densely scaled, anteriorly.

A 16-18, commences below the 2nd dorsal ray. Shape similar to dorsal. Densely scaled. Base of anal as long as base of dorsal.

P 12, base scaly. V 6, 3.5 in head, inserted midway between caudal base and hind margin to middle of opercle. Edge of fin concave. Base scaly. Caudal deeply forked, mid rays as long as eye, lower lobe longer.

Air-bladder simple.

Scales.—Lateral rows 61–64, l.l. $\frac{3}{3+28-29+28-29}$, predorsal 39–41, 6 between dorsal and 11. Lateral line tubes with numerous inferior tubules, resemble closely those of *delagoae* (see Plate X, C).

Colour (preserved).—Brown, darker above. Narrow dark stripe from base of caudal to axil of pectoral. Fins light.

Length.—Up to 220 mm.

Locality.—Mombasa.

Distribution.—Indo-Pacific.

The inclusion of this species in our fauna-list is based upon a specimen, lent by the British Museum, labelled *dussumieri* C. & V. from Mombasa. This specimen agrees generally with the diagnosis of *balinensis* Blkr., but differs in the rather light scaling on the vertical fins. Circumstances prevented a comparison of this specimen with two specimens of *balinensis* Blkr. subsequently kindly presented by Dr. de Beaufort, but there is little doubt that the Mombasa specimen is conspecific. The above description is based chiefly upon the two Indo-Pacific specimens.

Hemirhamphus improvisus n. sp.

(Plate XI, fig. 1.)

Body elongate, robust, slightly compressed, sides slightly convex, width 1·3 in depth. Depth 8·5, length of head 4·5, in length of body. Lower jaw 3·4 in body, 5 in total length. Eye 3·9 in head, 1·6 in snout, and in postorbital part of the head, 1·2 in interorbital width. Width of snout before the eyes 1·5 in length of snout. Head depressed, interorbital flat, with 2 shallow longitudinal grooves. No scales on occiput or interorbital, but these may have fallen off. Scarcely perceptible medio-longitudinal ridge on triangular part of upper jaw, which latter is slightly broader than long, scaly (fig. 1, B), 6–7 longitudinal and 3 or 4 transverse series: scaling extends over medio-longitudinal ridge. Width of lower jaw below tip of snout $\frac{3}{8}$ diameter of eye.

Tricuspid teeth in 5–6 rows in lower, and in 6–7 rows in upper jaw. Beak fairly stout, cutaneous fringes half as wide as beak; subgular sac moderate. Preorbital deeper than long, depth 1·8 in eye, a central pore indicating a scale, evidently fallen off. 2 large and 1 small scales on opercle. 2–3 series of scales on cheek, scaling extending forward on mandible to below middle of upper jaw. Gill-rakers 20, slender, 1·5 in gill-filaments, which are about 2 in eye. Branchiostegals 10: membrane naked; mentum narrow, naked.

D 14, arises very slightly in advance of midway between bases of caudal

The South African Species of the Genus Hemirhamphus Cuv. 143

and ventral. Anterior rays elevated, 4th longest about 2 in head; remainder decrease, edge of fin concave. Scaleless.

A 15, arises below 2nd dorsal ray. Similar in shape to dorsal, anterior rays slightly longer than longest dorsal rays. Fin scaly anteriorly and along base. Base of anal 1.2 in base of dorsal.

P 13, not scaled, 1.5 in head.

V 6, not scaled, length 2.6 in head, 2nd ray longest, 1st and 3rd equal, remainder decrease. Inserted midway between base of caudal and middle



FIG. 1.—Diagram to show type of scaling on upper jaws of A. *Hemirhamphus knysnaensis* n. sp. and B. *Hemirhamphus improvisus* n. sp.

of preopercle. Caudal slightly emarginate, mid rays 2.5 times eye. Lower lobe slightly longer than upper. Peduncle moderately slender.

Air-bladder simple.

Scales.—Lateral rows 53, l.l. $\frac{4}{2+22+25}$, predorsal 38, 6 rows between dorsal and lateral line. Lateral line tubes with 2–4 inferior tubules.

Colour.—Greenish above, silvery below. Nape, occiput snout, and top of opercle dark. Lower jaw and membranes black, tip of beak red. Median fins with dusky margins. A faint blotch on upper middle caudal rays. Remaining fins light. A silvery lateral stripe with dark upper border from base of caudal to axil of pectoral.

Length.—218 mm.

Locality.—Delagoa Bay.

Type in the South African Museum (No. 16368).

H. improvisus is closely related to *schlegeli* Blkr. and to *knysnaensis* n. sp., but is sharply distinguished from these by the character of the scaling on the triangular part of the upper jaw. In *improvisus* the middle of the 3 longitudinal series of scales is disposed centrally over the median ridge on the upper jaw, while the other two species have only 2 longitudinal series of scales which do not cover the median ridge (fig. 1, A and B).

H. improvisus is further distinguished from *schlegeli* and *knysnaensis* by the more anterior position of the ventrals and by the more obtuse upper jaw. The interorbital is markedly wider and the dorsal fin originates further back in *improvisus* than in *schlegeli* or *knysnaensis*.

Hemirhamphus knysnaensis n. sp.

(Plate XI, fig. 2.)

1916. Thompson, Mar. Bio. Rep., iii, p. 266 (*calabaricus*).

1925. Barnard, Ann. S.A. Mus., xxi, p. 262 (*calabaricus* part).

1929. Fowler, Ann. Nat. Mus., vi, pt. 2, p. 250 (*unifasciatus*).

Adults.

Body elongate, slender, slightly compressed, about $1\frac{1}{2}$ times as deep as wide. Depth 9.3–10.9, length of head 4.3–5, in total length. Eye 4–4.3 in head, 1.5–1.6 in snout, 1.5–1.7 in postorbital part of the head, and subequal to the interorbital width. Width of snout before eyes about $\frac{2}{3}$ of its length. Head depressed, with 2 shallow longitudinal grooves. Top of head scaly. Medio-longitudinal ridge on triangular part of upper jaw, which latter is slender, 1.1–1.3 times longer than wide, scaly, 4–5 longitudinal and 2 transverse series of scales: scales not overlapping medio-longitudinal ridge (fig. 1, A). Width of lower jaw below tip of snout about half-eye diameter. Minute curved conical teeth (unicuspid) in 2–3 rows in lower and 3–4 rows in upper jaw; a few tricuspid inner teeth in larger specimens. Beak slender, cutaneous fringes as wide as beak; subgular sac small. Preorbital slightly longer than deep, less than eye, covered by a single scale with central pore. Opercle with one small and two large scales. 2 series of scales on cheek, scaling extends forward along side of mandible about an eye diameter beyond below the tip of the snout.

Gill-rakers 25–28, slender, 2 in gill-filaments, which are slightly longer than 2 in eye. Branchiostegals 10, membrane and mentum scaleless.

D 16–17, arises considerably in advance of midway between bases of caudal and ventral. Anterior rays slightly elevated, 3rd longest, about 3 in head; remainder decrease to the last, which is about 5 in head.

Edge of fin slightly concave. Scaleless.

A 16–18, commences below the 2nd or 3rd dorsal ray. Shape similar to that of dorsal. Length of base slightly less than that of dorsal. Scaleless, or few basal scales in large examples.

P 11, conspicuously short, 1.8–2 in head. Scaleless.

V 6, scaleless, about half the length of the pectoral, inserted midway

The South African Species of the Genus Hemirhamphus Cuv. 145

between base of caudal and base of pectoral to hind margin of operculum ; usually nearer base of caudal than hind margin of head. Anterior rays longer.

Caudal moderately forked, upper lobe shorter, 1.2 in lower : mid rays 1.6-2 times eye. Peduncle slender.

Air-bladder simple.

Scales.—Lateral rows 55-58, l.l. $\frac{3}{3+26-28+22-24}$, predorsal 34-35, 5-6 rows between dorsal and lateral line. Lateral line tubes with one to four inferior tubules (Plate X, B).

Colour.—Blue-green above, silvery below. Nape, occiput, snout, and opercle dusky. Beak and membranes black, tip of beak red. A narrow, plumbeous lateral stripe from upper edge of pectoral base to base of caudal, broadest (2 in eye) below origin of dorsal. In ripe males this stripe extends on to and over the lower caudal lobe. Anterior portion of dorsal dark, lighter posteriorly. A dark spot at the base of each dorsal and anal ray. Caudal with marginal area dusky. Remaining fins light.

Length.—95-220 mm.

Distribution.—South and east coasts of Africa. From False Bay to Natal, entering rivers, extending into fresh water.

Types from Knysna in the Albany Museum.

Juveniles.

The young of this species are very slender and show main divergence from the adult form in the extent of the prolongation of the lower jaw and to a lesser extent in the shape of the caudal. The dorsal, anal, and pectoral fins approximate throughout in size and shape to those of the adult. The ventral fins are scarcely visible in very small specimens (< 12 mm.), but thereafter rapidly attain and remain at the adult proportions.

When 7 mm. in length the young are transparent, with a few dusky specks on the dorsal surface. The mouth is very oblique, the lower jaw not prolonged, and the triangular part of the upper jaw many times wider than long. The caudal is symmetrical, almost truncate, and there is no trace of the lateral stripe. The lower jaw is first observed to project when the fishes exceed 10-12 mm. in length, and thereafter increases rapidly in relative length, the proportions of the adult in this feature being attained when the total length of the fish exceeds 30 mm.

The relative increase in the length of this feature is shown on p. 146.

At 10-12 mm. length the specks on the body are darker, and the first signs of the lateral stripe are seen as a series of short, dark longitudinal

Total length of specimen (mm.).	Lower jaw in total length.
16	16
20	10
23	6.6
27	5.5
31	5.0
33	4.6

lines. The lower caudal lobe is now the longer. The lateral stripe is visible as such in specimens exceeding 20 mm. in length, and the caudal is markedly asymmetric. The mouth becomes less oblique, and the prolongation of the upper jaw commences when the length exceeds 25 mm. At about 30 mm. total length the triangular upper jaw is about 4 times wider than long; at 70 mm. it is almost as long as wide; at 80–100 mm. as long as wide; thereafter gradually more acute, until in specimens over 200 mm. in length it is as much as 1.3 times longer than wide. At all stages the beak is black, the red tip appearing in the later juvenile stages.

This species is closely related to *schlegeli* Blkr. and *improvisus* n. sp., from which it is distinguished by the more acutely triangular part of the upper jaw as well as by the greater number of scales in a lateral series, and of dorsal and anal rays.

It is also related to *georgii* C. & V., from which it differs in the shorter beak, as well as in the more anterior position of the ventrals and in the greater number of dorsal and anal rays.

The two specimens from False Bay, very inadequately described by Fowler (*loc. cit.*) as *unifasciatus* Ranz, are most probably *knysnaensis*.

Breeding Habits, Etc.

H. knysnaensis appears to be present in the tidal rivers of South Africa throughout the year, extending into fresh water. Ripe fishes are first encountered in October and are most numerous in November and December. The young are exceedingly abundant in these months, and are present until February, after which they disappear. It is curious that the ripe fishes of this species have not been observed to congregate in any special areas, but are encountered in the surface of deep as well as shallow water, from two to four swimming one behind the other. Females predominate markedly in number.

The eggs are demersal, 1.6 mm. in diameter, almost transparent, and densely covered with glutinous hair-like filaments, considerably longer

The South African Species of the Genus Hemirhamphus Cuv. 147

than the diameter of the egg. The larger females produce about 10,000 eggs per season.

Hemirhamphus schlegeli Blkr.

1862. Bleeker, Mem. Soc. Holl. Haarlem, p. 120, fig. 1.

1866. Gunther, Cat. Fish. Brit. Mus., vi, p. 266 (*calabaricus*).

1866. Gunther, Ann. Mag. Nat. Hist. (3), xviii, p. 427 (*calabaricus-schlegeli* Blkr.).

1925. Barnard, Ann. S.A. Mus., xxi, p. 262 (*calabaricus* part).

Body elongate, subcylindrical, about $1\frac{1}{4}$ times as deep as wide.

Depth 9-9.4, length of head 4.4, in length of body. Lower jaw 3.3-3.6 in body, 5-5.2 in total length. Eye 3.8-4 in head, 1.2-1.3 in snout, 1.5 in postorbital part of the head and subequal to the interorbital width. Width of snout before eye $\frac{3}{8}$ of its length. Head depressed, interorbital flat, with 2 shallow longitudinal grooves, scaly, 3 transverse series. Medio-longitudinal ridge on triangular part of upper jaw, which latter is slender, as long as wide, scaly, 3-4 longitudinal and 2 transverse series of scales, not overlapping median ridge. Width of lower jaw below tip of snout about half eye diameter. Small conical, bi- and tricuspid teeth in 3 rows in each jaw. Beak slender, cutaneous fringes almost as wide as beak; subgular sac small. Preorbital almost as deep as long, covered by a single scale with central pore. Three series of scales on cheek, scaling extends forward to below corner of mouth; a single line of pores on the side of the chin.

Gill-rakers 22-26, slender, 2-3 in gill-filaments, which are about 1.5 in eye. Branchiostegals 10, membrane scaleless.

D 14, arises considerably in advance of midway between bases of caudal and ventral. Anterior rays slightly elevated, 3rd longest, 2.5 in head, remainder decrease, last 5 in head. Edge of fin gently concave. Scaleless.

A 15-16, commences below 2nd dorsal ray. Shape similar to dorsal; slightly higher than dorsal. Length of base slightly less than that of dorsal. Scaleless.

P 11, 1.7-1.8 in head, scaleless.

V 6, scaleless, half the length of the pectoral, inserted midway between base of caudal and hind margin to middle of opercle. Anterior rays longer.

Caudal emarginate, upper lobe shorter, 1.3 in lower. Mid rays 1.5-1.7 times eye. Peduncle slender.

Scales.—Lateral rows 50, l.l. $\frac{4}{2+24+22}$, predorsal 35, 6 rows between dorsal and lateral line. Lateral line tubes with 2 or 3 inferior tubules. Air-bladder simple.

Colour (preserved).—Brownish yellow, darker above. A dark lateral stripe from base of caudal to axil of pectoral, widest below origin of dorsal.

Anterior dorsal rays and margin of caudal dusky. Remaining fins light. Beak black.

Length.—140–215 mm.

Locality.—Angola, Cameroons.

Distribution.—West coast of Africa.

This species does not strictly belong to the South African fauna, but is included here since it is almost certain to be discovered within our region.

Fowler (Ann. Nat. Mus., 1929, vi, pt. 2, p. 250) considers *schlegeli* identical with *unifasciatus* Ranz. This is scarcely possible, since this latter species has a very short beak, ventrals inserted midway between caudal base and eye, and dense scaling on the dorsal and anal fins.

Notes on the Hemirhamphidae.

These fishes appear to live almost exclusively in the surface of the water, and show high specialisation of habit with adaptive modifications in external form.

The leaping powers of the species of *Hemirhamphus* are markedly characteristic. These fishes emerge from the water with the body rigidly straight, and the leap is terminated either by falling flat upon the surface, or, in the case of the smaller specimens, with the caudal first entering the water. I have not yet seen any of these fishes ending a leap by diving head first into the water. The ventrals are fully extended laterally during the leap. As many as six or seven immediately consecutive leaps have been observed, the pause between each for renewal of the impulse being extremely brief. Adult specimens of *H. far* cover 10–15 feet in each leap, and are able to progress up to 100 feet along the surface in this manner, at an average speed of at least 25 feet per second. Very young specimens of this species are apparently unable to emerge from the water and are very easily captured, even by day. *H. knysnaensis*, a smaller species, progresses in a similar fashion along the surface, but the body is held at an angle of about 45° to the surface, the leaps are very short, 1–2 feet, and are seldom repeated more than 4 or 5 times. Half-grown specimens of this species show an interesting stage in the development of this power. When startled, these fishes shoot up until the body as far as the ventrals is out of the water at an angle of about 45° to the surface: with ventrals widely extended, the body is held in this position, and urged forward along the surface for a few yards at a surprising rate, the caudal vibrating with extreme rapidity. As far as has been observed, none of these fishes, small or large, attempt to escape attack, even from above, by diving, which would appear to indicate that they do not readily sink from the surface for any purpose.

The South African Species of the Genus Hemirhamphus Cuv. 149

The leaping powers of these fishes have led Schlesinger (Phy. and Eth. d. Scombr., Verh. Zoo. Bot. Ges. Wien, 1909, lix, pp. 302-339) to conclude that the closely related *Exocoetidae* have developed from the *Hemirhamphidae*. It would appear more reasonable to suppose that both forms have developed simultaneously from a common surface-dwelling ancestral type, the enlargement of the "beak" of the *Hemirhamphidae* and the pectorals of the *Exocoetidae* representing later specialisation. The very young stages of species of *Hemirhamphus* have no "beak," while the pectorals of the very young of certain species of the *Exocoetidae* are relatively considerably less elongate than those of the adult fishes.

The adoption of a purely surface life in the case of the *Hemirhamphidae* (and of the *Exocoetidae*) is further indicated by the ventro-lateral position of the lateral line in these fishes.

Functions of the "Beak."

Schlesinger (*loc. cit.*) has concluded that the prolonged lower jaw of the *Hemirhamphidae* is employed to plough up the bottom mud in search of food, and he discounts the statements of other investigators that the stomach contents of these fishes consist solely of surface plants and organisms.

It has been previously indicated that there are reasons for believing that the *Hemirhamphidae* are exclusively surface-dwellers. I have examined microscopically the stomach contents of many specimens of various species of *Hemirhamphus*, and it is significant that in no case was any trace of sand-particles observed. The aliments generally appear to consist of surface plants, larval crustacea and fishes, and pelagic eggs. The *Mugilidae* are also surface-dwellers, but feed not only upon surface organisms, but also upon material obtained by skimming or stirring up the bottom mud and eel-grass (*Zostera*) in shallow water; sand particles are invariably present in the aliments of the *Mugilidae*, frequently in large proportions. It appears inconceivable that the *Hemirhamphidae* could eliminate all trace of sand particles from food obtained by stirring up mud with the beak.

Further, the tip of the beak of a live *Hemirhamphus* is soft, and the distal portions of the lateral cutaneous fringes extremely delicate and fairly vascular. These fishes rapidly succumb when the beak is damaged, and it is perhaps significant that among many hundreds of specimens I have taken alive none have been found with a broken beak. It would therefore appear extremely unlikely that the "beak" is employed in the manner suggested by Schlesinger.

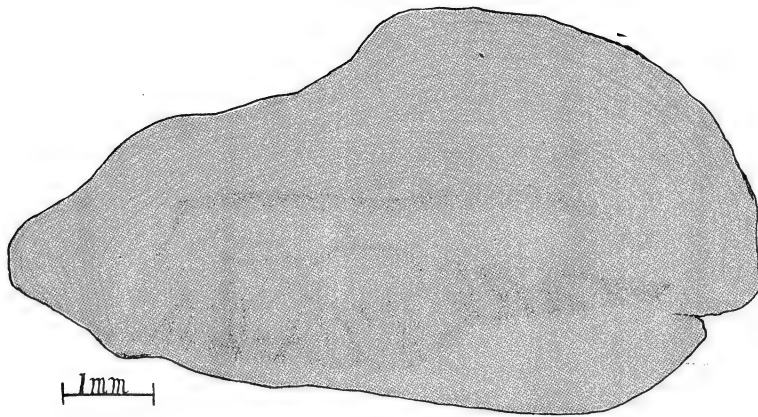
From sustained observations, chiefly by night with the aid of a powerful light, it appears not unlikely that the prolonged lower jaw, with its cutaneous

fringes, is employed by these fishes as an organ for the detection of the minute surface organisms which constitute their food. They lie in the surface of the water with the cutaneous fringes of the beak fully extended laterally. At frequent intervals the head may be seen to be jerked slightly to one side, the body urged forward, and motions concomitant with the assimilation of some particle ensure. Specimens will lie undisturbed in the light of a lamp, if cautiously approached; the body may be touched with a very fine wire without occasioning undue alarm, but if the beak is only lightly touched, the fish withdraws violently.

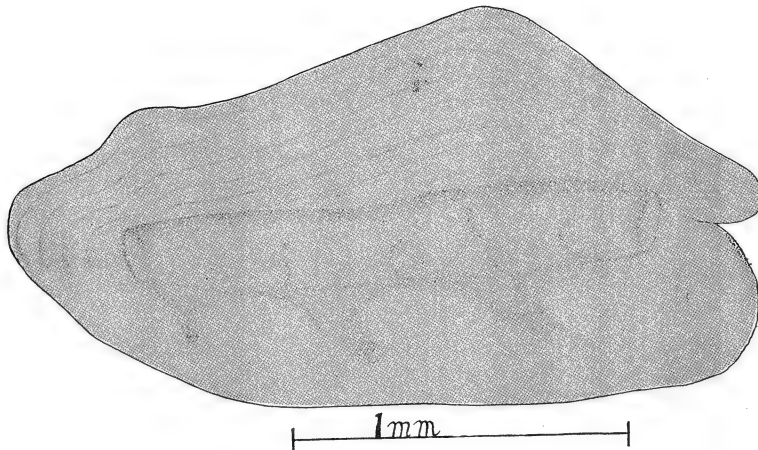
The function of the subgular sac remains obscure. The contents of the distended sac (rarely so observed after capture) appear to be liquid, and not gaseous, but sufficient could not be obtained for investigation.

I wish to express my gratitude to Mr. J. Hewitt, Director of the Albany Museum, and to Dr. K. H. Barnard, Assistant Director of the South African Museum, for advice and assistance, and for the loan of material and literature; to Mr. J. R. Norman of the British Museum for the loan of, and to Professor de Beaufort of Amsterdam, for the donation of, valuable specimens. Also for financial assistance from the Carnegie fund, through the Research Grant Board of South Africa, which defrayed part of the costs of the investigation.

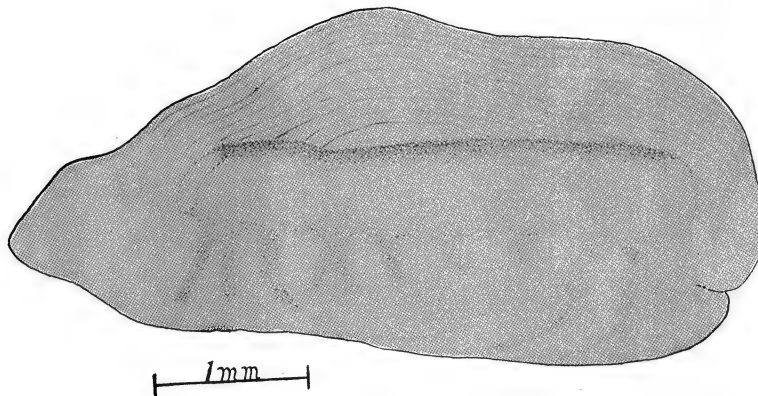
ALBANY MUSEUM,
GRAHAMSTOWN.



A



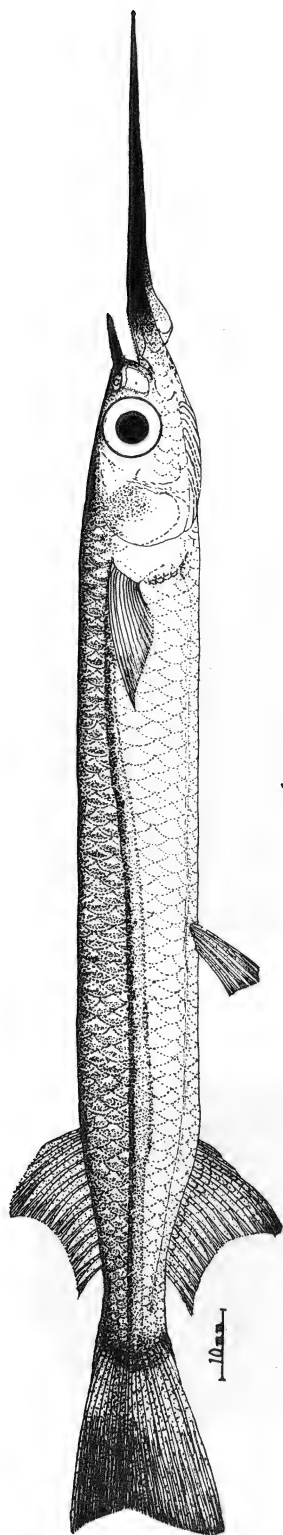
B



C

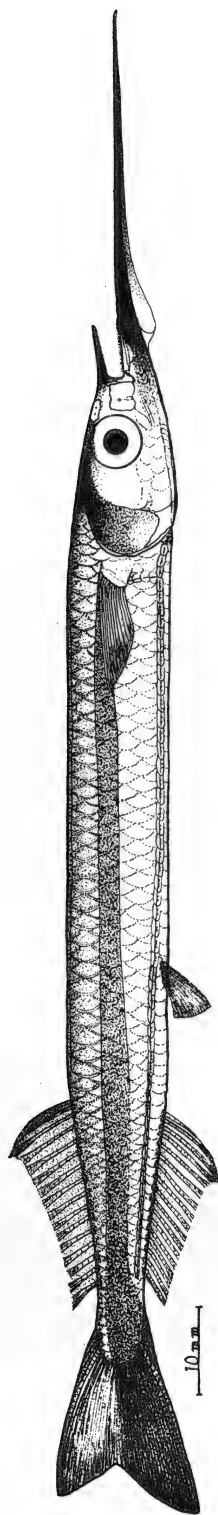
LATERAL LINE SCALES, SEMI-DIAGRAMMATIC.

- A, *Hemirhamphus far* Forsk.
B, *Hemirhamphus knysnaensis* n. sp.
C, *Hemirhamphus delagoae* Brnd.



1

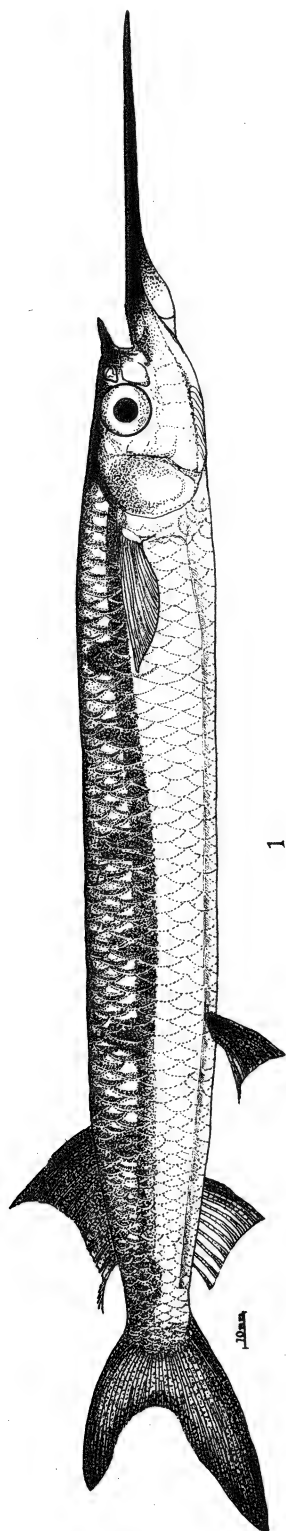
J. L. B. Smith.



2

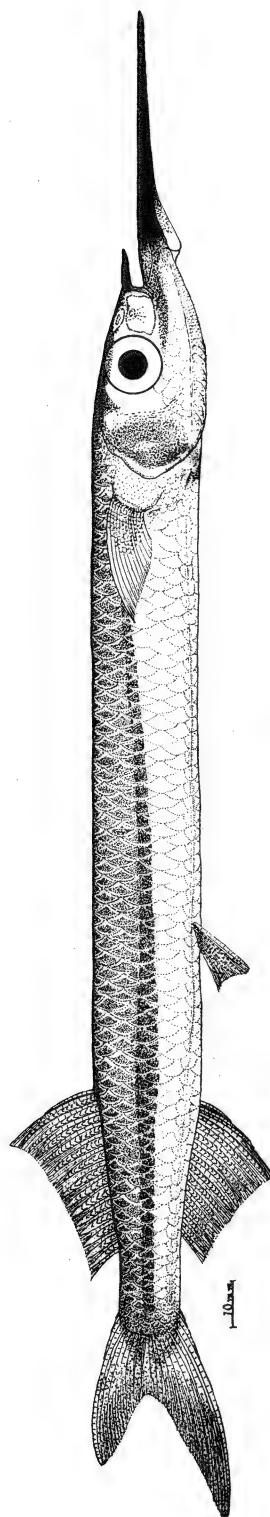
1. *Hemirhamphus improvisus* n. sp.
2. *Hemirhamphus knysnaensis* n. sp. (male).

Neill & Co., Ltd.



1

J. L. B. Smith.



2

1. *Hemirhamphus far* Forsk.
2. *Hemirhamphus delagoae* Brnd.

Neill & Co., Ltd.

Transactions of the Royal Society of South Africa. Vol. XXII.
Part I. pp. 83–87. Pl. IV. August, 1934.

THE GROWTH CHANGES OF *PTEROPLATEA*
NATALENSIS, G. AND T.

By J. L. B. SMITH.

(With Plate IV and one Text-figure.)

FAMILY DASYBATIDAE.

Genus *PTEROPLATEA*, Müller and Henle.

1913. Garman, Mem. Mus. Comp. Zool. Harv., p. 412.

1925. Barnard, Ann. S.A. Museum, vol. xxi, p. 80.

To the diagnosis of this genus add the following: "An ovoid flap of the iris extending over the pupil from the upper margin, increasing with age. A wide but low crenulate cutaneous flap on floor and on roof of mouth, behind the dental laminae, may be present. A small tentacle, on the inner posterior margin of the spiracle, sometimes present, decreasing with age, possibly becoming obsolete in large sexually mature individuals."

Pteroplatea natalensis, G. and T.

1911. Gilchrist and Thompson, Ann. S.A. Mus., vol. xi, pt. 2, p. 56.

1925. Barnard (*loc. cit.*), p. 81.

The holotype of this species is a juvenile male from Natal, 280 mm. across the disc. It possesses a small pointed tentacle on the inner posterior margin of the spiracle, while the disc is markedly triangular in shape, with undulate anterior margin. The caudal spine has been stated not to be serrate, but this is an error. The serrations are present, but are hidden under the skin or by a coating of mucus.

The only other species recorded from South Africa is *micrura*, Bl. Schn. The identification is based upon two large specimens, one stuffed, one cast (from the Agulhas Bank), in the S.A. Museum. This species has no tentacle, and the disc is subrhomboidal in shape.

Very little appears to be known about the habits and development of species of this genus, nor, in so far as I have been able to ascertain, have the growth changes of any species been previously described.

The present work is based upon the examination of a graduated series

of specimens, ranging from 104–1830 mm. across the disc, secured in the course of experimental netting in the Knysna estuary.

These fishes appear to enter the river chiefly during the late summer and early winter months, but have been observed throughout the year. Of the specimens mentioned above, only two were sexually mature. These were gravid females, 1790 and 1830 mm. across the disc respectively, and each proved to hold eight embryos. The smaller of the two was taken near the mouth of the river, while the larger was captured about seven miles higher, where the salinity of the water is very considerably lower than that of the sea. The netters state that very large as well as very small specimens are by no means infrequently taken in the autumn. It is possible that gravid females may seek out the more protected waters of the river to give birth to the young. Since, however, sexually immature individuals are as frequently present, it is possible that the entering of the river may be purely fortuitous, for the mouth of the Knysna River is both wide and deep.

In so far as may be judged from the stomach contents, the food of these fishes appears to consist of small fishes (*Sparus sarba* Forsk. and *Mugil* sps.) and crustacea, chiefly crabs.

The larger of the two gravid females to which reference is made above might easily have been mistaken for a specimen of *micrura*, since there was no trace of a spiracular tentacle, and the disc was much less triangular in shape than that of the type of *natalensis*. The embryos it contained (5 ♀, 3 ♂) are, however, quite apparently conspecific with *natalensis*, since these all possess the spiracular tentacle, and are even more markedly triangular in shape than the type. These embryos (104–117 mm. across the disc) are far from mature: the appendicular yolk-sac is large, the caudal spine is unossified and adnate, while chromatophores are not visible, and filamentous external accessory gills are present. In the smaller of the two females (1790 mm.) the spiracular tentacle has been reduced to a mere knob, while the disc resembles that of the larger female. The embryos (6 ♀, 2 ♂, 265–280 mm. across the disc) are in this case mature. The yolk has been fully absorbed, external gills are absent, the coloration is fully developed, and the caudal spine is ossified, serrate and free. All possess the spiracular tentacle. One of these is shown in Pl. IV, fig. 2.

Embryonic Forms.

The width of the disc in the embryos is 1.6–1.7 times the length (tip of snout to level of hind margin of disc). The mid-point of the line joining the pectoral apices is 3.5–5.0 times as far from the tip of the snout as from the hind margin of the disc (in the type specimen 4.3). There does not

appear to be any appreciable change in the shape of the disc from the early to the later stages of embryonic development. The interorbital width is 0.9–1.3 in the snout (for convenience measured from midway between the centres of the eyes to the anterior point of the disc). In the very small specimens the eyes are pedunculated, and the developing iridal flap shows as a small but sharp convexity at the upper margin of the pupil. The caudal is 1.3–1.8 in the length of the disc, with a moderate cutaneous fold above and below. The ossification of the caudal spine is evidently one of the later processes of embryonic development, possibly taking place while the whole spine is adnate to the body of the caudal. The accessory external filamentous gills of the very small specimens are considerably longer than the disc. The coloration of the mature embryos is very similar to that of half-grown individuals, except that numerous round spots are more obvious.

Post-natal and Mature Stadia.

The disc changes from subtriangular to subrhomboidal with growth, becoming also relatively broader (fig. 1, A–F). The posterior margin of

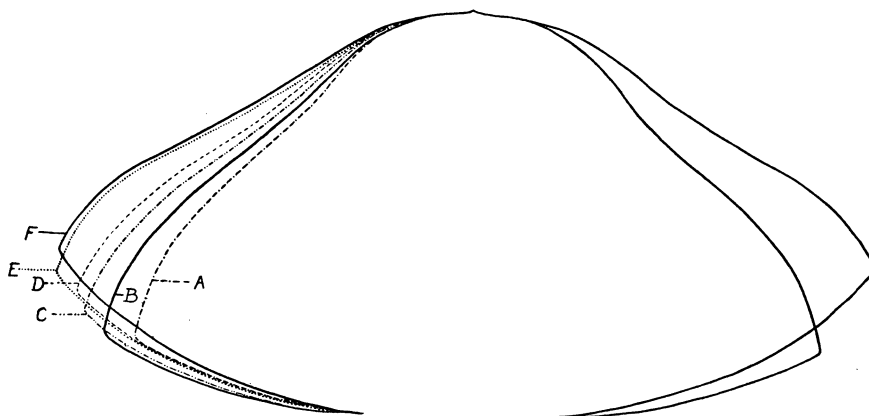


FIG. 1.—Diagram to illustrate the change in shape of the disc of *Pteroplatea natalensis*, G. and T., with growth. Width of disc in mm.: A, 105; B, 280; C, 435; D, 610; E, 1080; F, 1830.

the disc is gently convex, sometimes finely scalloped. The anterior margin of the pectoral is gently undulate, with concavity about midway between pectoral apex and snout. The pectoral apices become less obtuse with growth. The interorbital width is equal to or slightly greater than the snout (see above). The eyes are prominent, and the iridal flap in the larger specimens covers most of the pupil. Length of spiracle about 2.5 in interorbital width, which is 10–12 in disc width. The

spiracular tentacle in young and half-grown individuals is slender and pointed, 8–10 in spiracle length; apparently diminishes with age. Caudal small, diminishing in relative length with growth (the accidental shortening of this organ by injury is frequently observed in *Dasybatids*). Cutaneous fold, above and below, moderate. One or, more usually, two serrated spines near caudal base, short and stout. No dorsal fin or, as observed in one case, a mere rudiment, reduced to a small fold of thickened skin immediately anterior to the caudal spines. Skin smooth. Teeth tessellate, each rhomboidal base with a flattened triangular retrorse point. The number of the teeth in each row and the number of rows increases from 40 rows of 8–10 each in the smaller to 110 rows of 15–20 each in the largest specimens. Anterior and posterior margins of each lamina undulate: the upper lamina with anterior median convexity, the lower with median anterior concavity (Pl. IV, A and B). (Barnard's comment, *loc. cit.*, p. 81, on the paragraph about the dental laminae in the original description is rather severe. The meaning of this rather obscurely worded paragraph becomes clear when the laminae are examined.) Colour uniform brown above, or with darker or lighter vermiculations and blotches, light below. Tail with alternate dark and light annulations, becoming obscure in adults.

The following table indicates the chief changes which take place with growth :—

Sex.	F. ¹	M. ²	M. ³	F.	F.	F. ⁴	F.	F.
Width disc in mm. .	105	265	280	435	610	1080	1790	1830
Length disc in width .	1·6	1·7	1·75	1·85	1·9	2·1	2·1	2·0
Caudal in disc length .	1·5	1·8	2·0	2·5	2·0	2·1	2·5	3·3
Pectoral line ⁵ .	5·0	4·2	4·3	3·2	2·6	1·95	1·6	1·6
In fig. 1	A	..	B	C	D	E	..	F

¹ Most triangular immature embryo.

² Plate IV, fig. 2.

³ Type specimen.

⁴ Plate IV, fig. 1.

⁵ The number of times that the mid-point of the line joining the pectoral apices is farther from the tip of the snout than from the posterior margin of the disc.

This species is very closely related to *altavela* Linn., from the tropical Atlantic, from which it apparently differs in the markedly triangular disc, in the more obtuse pectoral apices and in the more more undulation of the anterior margins of the pectorals. These differences are slight, especially since *altavela* appears to be of somewhat variable form. Garman (*loc. cit.*, p. 415) considers *canariensis* Val., *valencienni* Dum., and *vaillantii* Rochebr. conspecific with *altavela*. It is possible that the earlier figures of species are not always to be relied upon, but I have seen those of these

The Growth Changes of Pteroplatea natalensis, G. and T. 87

synonyms, and they differ very considerably one from the other. It is not unlikely also that very different stadia have been figured.

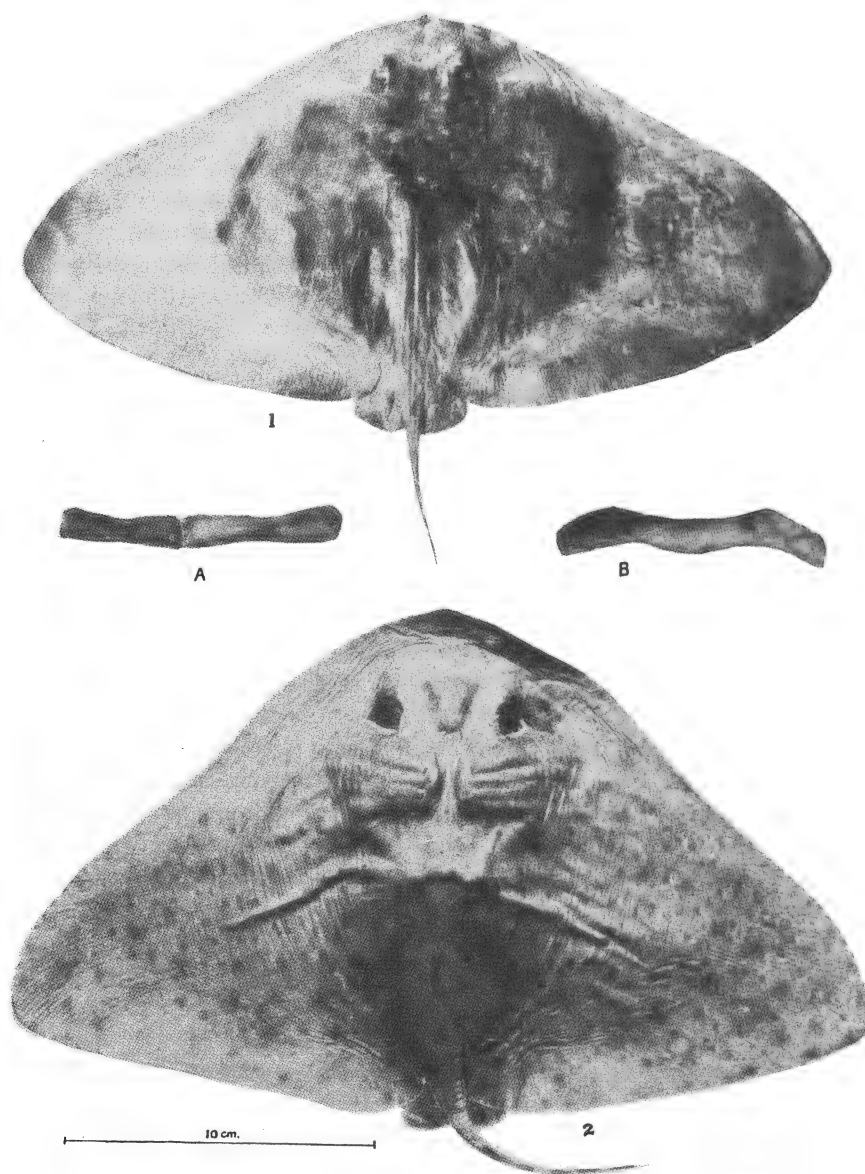
I may here call attention to the fact that descriptions of the species of this genus rarely include the precise size of the specimens described, which, in view of the evidence here adduced, considerably diminishes their value. It would not indeed be surprising if *natalensis* were to be found conspecific with *altavela*. Barnard, *loc. cit.*, probably had some such idea, since he remarks that the adult of *natalensis*, when found, would probably be found referable to a previously known species. I do not feel justified in pronouncing *natalensis* a synonym of *altavela*, since I have seen no authentically named specimens of the latter.

It may be remarked that the growth changes of *natalensis* indicate that a revision of this genus, based upon adequate material, would probably result in a somewhat drastic limitation of the number of species. It is evident that the shape of the disc, the length of the caudal, and even the presence or absence of the spiracular tentacle are, unless many equivalent stadia are compared, not as reliable a guide to the differentiation of species as may hitherto have been supposed.

At Knysna, *natalensis* is named "Backwater" by the netters: when caught, the fish lies flat against the net and so renders the retraction extremely arduous. The species is for this reason an extremely unwelcome capture, and also, in addition, since its presence in the net appears to terrify the other fishes, great numbers of whom escape by jumping over the net. At Knysna this species is seldom taken on lines, but farther east it is not an infrequent capture. A large specimen of presumably this species was recently taken on a line in the Keiskama River, and in Natal waters it is no infrequent capture, large specimens proving formidable antagonists to the angler.

I wish to express my gratitude to Dr. Barnard, Assistant Director of the S.A. Museum, for his kind assistance in regard to material and literature in the S.A. Museum. Also to the Carnegie Research Fund (through the Research Grant Board of South Africa) for financial assistance.

ALBANY MUSEUM,
GRAHAMSTOWN,
August 1933.



PTEROPLATEA NATALENSIS, G. and T.

1. Half-grown female, $\times 1\frac{1}{2}$.
2. Mature male embryo.
- A. Upper dental lamina of a specimen 1830 mm. disc width.
- B. Lower dental lamina of same.

MARINE FISHES OF SEVEN GENERA NEW TO SOUTH AFRICA.

By J. L. B. SMITH.

(With Plates V and VI, and one Text-figure.)

The following new genera are described below:—

Family STROMATEIDAE, *Papyrichthys*.

Family BATRACHOIDIDAE, *Batrachichthys*.

Family SYNGNATHIDAE.

Microphis brachyurus Blkr.

1888. Day, Fishes of India, p. 680, pl. clxxiv, fig. 3 (*Doryichthys bleekeri* Day).

1922. Weber and de Beaufort, Indo-Aus. Fishes, iv, p. 44, fig. 21.

Body moderately slender, depth 4·5 in head, almost as wide as deep. Head 4·8 in length to caudal base. Tail (without fin) slightly shorter than half distance from snout tip to vent. Eye 10, snout 1·6, and post-orbital 3·4 in length of head.

Operculum with a slight medio-longitudinal ridge for the entire length; on one side 3, on the other 5, similar shorter, curved, radiating ridges below, all feebly serrate. Snout very compressed, with supero-medial ridge. Supra-orbital ridge continuous from temporal region on to snout. All ridges on head and snout feebly serrate.

Rings 22 + 23. Each body plate has 14–18 smooth parallel vertical ridges, which sometimes become furcated and reticulate below. Across

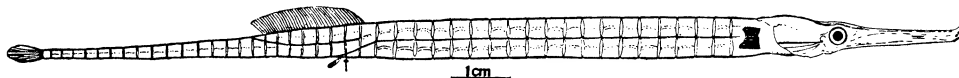


FIG. 1.—*Microphis brachyurus* Blkr.

the middle of each plate are 3 longitudinal curved ridges. The edge of each plate is serrulate, the serrae corresponding in number with the vertical ridges; last spinelet in each plate slightly enlarged.

The supero-lateral body ridge is discontinuous with the supero-lateral caudal ridge, and extends to the 7th caudal ring. The medio-lateral body

ridge curves down below the origin of the dorsal and unites with the infero-lateral caudal ridge on the 2nd caudal ring. The infero-lateral body ridge is not continuous with the infero-lateral of the caudal, and curves on to the ventral surface of the caudal, ending in the 2nd caudal ring. The supero-lateral caudal ridge curves down (forwards) below the hind end of the dorsal to medio-lateral, and extends as far as the hind margin of the last body ring.

D 40, base not raised, as long as snout, originates on penultimate body ring, on 9 rings (2 + 7).

A 5, very small, inserted below anterior dorsal rays.

P 19, slightly longer than eye, emarginate. Caudal small, about 3 in snout, rounded. No brood pouch visible, presumably a female specimen.

Colour.—Light brown, margins of plates lighter. Fins light; caudal dark.

Length.—160 mm.

A single specimen, from Durban, presented by E. C. Chubb, Esq., Curator of the Durban Museum.

M. brachyurus has been recorded from East Africa to the Indo-Pacific. The only other species of this genus hitherto recorded from Africa is *smithii* Dum., from the tropical west coast, which is stated to be fluviatile.

M. brachyurus is closely related to this species, differing only in certain minor features, such as the longer snout and the more posterior insertion of the shorter dorsal. It is possible that wider collection may show that the two forms are identical. It appears preferable to maintain the Indian Ocean form as a separate species until such time as the recorded areas may be linked up.

Family PLECTORHYNCHIDAE.

Scolopsis vosmeri (Bloch.).

(Plate V, A.)

1878. Day, Fishes of India, p. 87, pl. xxiii, fig. 1.

Dorsal profile even, body compressed, ovate. Depth 2.1, length of head 2.9 in length of body: eye 3.1 in head, slightly greater than snout and than interorbital width, 1.1 in postorbital part of head. Preopercular margin concave, strongly serrulate, spinelets directed obliquely outwards. Preorbital produced backwards into a prominent flat spine, extending almost to below hind margin of pupil: 5 graduated smaller spines below. Suborbital feebly serrated. Muciferous pores on anterior part of head. Mouth small, terminal, maxilla extends to below anterior margin of eye, almost entirely concealed beneath preorbital. Villiform teeth in bands in both jaws, tapering towards the sides, which have only a single row of

teeth. Palate and tongue edentate. Gill-rakers 5, very short and stout; 3 in gill-fringes, which are 2.5 in eye.

D X 9, commences above middle of operculum, not notched. 1st spine shortest, 4.4 in head; 2nd 3.1; 3rd 2.6; 4th and 5th longest, 2.4; last 2.8 in head. Anterior rays equal to last spine.

A III 7, commences below the 2nd dorsal ray. 2nd spine very stout, longest slightly longer than 4th dorsal spine. Vertical fins not scaly.

P 18; 1.3 in head, rounded.

V I 5, 1.25 in head, inserted below 6th dorsal spine; 1st ray filamentous, reaches to base of 2nd anal spine.

Caudal forked, upper lobe longer.

Scales ctenoid, l.l. 41, ltr. $3\frac{1}{2}/14$; l.l. tubes bifurcate on anterior scales. Some posterior l.l. scales have 2-3 superior branches each ending in a pore. l.l. scales smaller than body scales, 4-5 series on cheek.

Colour.—Yellow-brown, with a light band over the nape and a light stripe along the side. Dorsal dark anteriorly, other fins light; axil of pectoral and upper hind margin of operculum black.

Length.—107 mm.

Locality.—Presumably Port Alfred, having been found together with other unlabelled fishes among the old collection of the Albany Museum.

Distribution.—Indo-Pacific.

This is the first authentic record of a species of this genus from South Africa. As mentioned by Barnard (Ann. S.A. Mus., 1925, xxi, p. 669), Playfair and Gunther record *Scolopsis monogramma* K. and v. H. from Mozambique, but without citing any authority.

I have seen no recent work dealing with the species of this genus, but the older differentiation, based apparently largely upon coloration, appears none too sound, and is probably in need of revision.

The presence of this species on our southern coast is noteworthy. The stretch of coast from Algoa Bay to East London has not before received much attention from ichthyologists, and has proved a rich collecting ground. Numerous species formerly believed to be confined to the western and south-western coasts (among others *Congiopodus torvus* (Gron.) and many species of *Clinus* Cuv.) have been found commonly occurring there, while many species normally accounted as tropical (e.g. among others *Petroscirtes tapeinosoma* (Blkr.), *Monoceros Unicornis* (Forsk.), and *Albula vulpes* (Linn.)) have also been found.

The occurrence of the present species is therefore not in any way exceptional.

Family BROTULIDÆ.

Grammonus opisthodon n. sp.

(Plate VI, B.)

Body compressed, moderately elongate, tapering uniformly from nape. Depth 4, length of head 3·2 in length of body. Eye 7, snout 4, interorbital 3·2, and postorbital 1·7 in length of head. Nostrils widely separated, anterior on snout. No barbels or spines on head, except for a strong spine, and a second, weaker, diverging on opercle. Preopercle margin below skin, with an obtuse ridge at the angle. Muciferous pores on head, very marked on chin. Snout obtuse, somewhat swollen. Mouth terminal, large, slightly oblique. Maxilla extends well behind eye, its length 1·7 in length of head, posteriorly dilated to a width equal to eye, with a retrorse spine on the hinder lower edge. A single series of fairly large curved conical teeth in each jaw: no villiform teeth. Two separate obtuse vomerine knobs, each with two large conical curved teeth. Palatines, other bones, and tongue edentate. Gill-membranes separate, free from isthmus. Gills 4, a slit behind the 4th. Gill-rakers 3, long and spinose, plus 5 spinous flattened ridges anteriorly. Pseudobranchiae absent. Branchiostegals 6. Vent postmedian.

D 65, originates 1·6 times as far from caudal base as from tip of snout, over middle of pectoral.

A 35, originates 1·5 times as far from tip of snout as from caudal base. Median fins confluent with caudal.

P 23, 1·5 in head, rounded, base enlarged.

Ventrals each reduced to a single filament, about 4 in head, inserted below the opercle.

No sign of any scales, or of lateral line.

Caudal small, pointed.

Length.—50 mm.

Locality.—Port Alfred.

Colour.—Brownish, with numerous small black spots.

This interesting small specimen is unfortunately not in very good condition, and the absence of scales and lateral line cannot therefore be regarded as established. Since it does not appear to fall into any genus of this family of which I have a description, I forwarded the specimen to Mr. Norman of the British Museum, who, at my request, compared it with the Brotulids in their collection. It is apparently identical with none of these.

I have provisionally assigned it to *Grammonus* Gill, with the diagnosis of which it agrees broadly. It differs in many features, however, the

most marked being the presence of the maxillary spine, and in the absence of villiform teeth in the jaws and on the vomer, as well as in the absence of scales and of lateral line.

Generic distinction in the Brotulidae appears to be rather fine, and the present species may well serve as the type of a new genus. This is, however, largely dependent upon the discovery of specimens in good condition, in which the presumed absence of scales and lateral line may be confirmed. This is the first record of a species of this genus from South Africa. Two other species are known, both from the Mediterranean: *ater* Risso is probably bathybial and is said to come inshore to spawn; the other is *armatus* Doederlein, about which little is known.

Family STROMATEIDAE.

Papyrichthys n.g.

Body ovate, very highly compressed, especially at the bases of the dorsal and anal fins, these regions being distinct from the body proper. Mouth large, slightly oblique. Maxilla excluded from margin of upper jaw, almost entirely concealed beneath preorbital. A single row of moderate fine-pointed teeth in each jaw. Palatal teeth present or absent. Branchiostegals 5. Gill-opening wide, membranes free, rakers well developed. Pseudobranchiae present.

Dorsal and anal very long, rays free from enveloping skin. Pectorals inserted low down. Ventrals of one short spine and five rays, longer than pectorals, inner rays longest, extending well behind origin of anal. Body and part of head covered with very small cycloid scales, probably always more than 100 in lateral series. Pores on head and body few or absent. Lateral line high, more or less following the dorsal profile. Air-bladder present. Pyloric caeca moderately numerous, branched. Vertebrae 40.

Genotype *pellucidus* Lütken.

This genus is related to *Psenes* C. and V., but it is well differentiated by the very minute scales, the size and shape of the ventrals, the very highly compressed body, and the greater number of vertebrae. I have examined a specimen of *Psenes indicus* Day, which apparently does not possess the many-branched pyloric caeca such as are found in *Papyrichthys*. This may prove a characteristic feature of this latter genus, although Regan (Ann. Mag. Nat. Hist., 1902 (7), X, p. 118) has given reasons why the nature of the caeca is not very reliable in defining genera in this family. *Psenes* is stated by Regan (*loc. cit.*) to have 25 vertebrae, but while he placed *pellucidus* in this genus, he had not seen a specimen, and merely followed Lütken's diagnosis.

The very highly compressed plastic body, and the dentition, would

indicate that *Papyrichthys* is related also to *Schedophilus* Cocco, but it is distinguished from this genus by the absence of pores on the body and of the thickened porous skin on the occiput, as well as by the course of the lateral line.

Papyrichthys pellucidus Lütken.

(Plate VI, A.)

1895. Goode and Bean, Ocean. Ichth., p. 221, pl. lxiii, fig. 228 (*Psenes pellucidus* Lütken).

1902. Regan, Ann. Mag. Nat. Hist. (7), X, p. 125 (*Psenes p.*).

Body soft and flabby, very compressed, maximum width at shoulder about 10 in length. Dorsal profile gently sloping from nape. Regions containing the dermal rays at bases of dorsal and anal fins very highly compressed, almost translucent, sharply defined. Snout very blunt, almost vertical, with slight mesethmoidal ridge.

Depth 2·8, length of head 3·0 in length of body. Eye 4·0, interorbital (convex) 5, snout 3·4, and postorbital length 2·1 in head. Interopercle with traces of marginal spinules. Other bones of head entire. Preorbital with anterior trifold ridge. Bones of head soft and cavernous. A few pores on chin and head. None on body. Nostrils close together, much nearer snout tip than eye. Mouth large, terminal, slightly oblique, jaws equal. Maxilla extends to below the anterior third of the eye; end of maxilla slightly expanded. A single comb-like row of moderate, fine, pointed teeth, slightly recurved, in each jaw; those in lower jaw slightly larger. Palatal bones edentate, but signs of small teeth on vomer. Tongue free, edentate. Gill-rakers 13, longest slightly shorter than gill-filaments, 3 in eye, not very close set, spinulate below. Pseudobranchiae well developed. Branchiostegals 5. Pyloric caeca 10, each lobate, many-branched.

D XII 34 (spines all broken, very weak), originates slightly behind preopercular margin. Anterior rays slightly shorter than mid-posterior, which are 1·7 in head. Hindmost rays slightly shorter. Bases of spines enveloped in skin; rays quite free, joined by membrane.

A 35 (or I 34), originates below the 4th soft dorsal ray. Shape similar to dorsal; hinder rays of same length as corresponding dorsal rays. Rays free from skin.

P 19, inserted low down, base slightly oblique. Fin rounded, 1·4 in head.

Ventrals I 5, inserted below the pectoral base, 1·3 in head, inner rays longest, reach to the base of the 5th anal ray.

Caudal damaged (forked according to G. and B., *loc. cit.*), 10 + 16 + 10. Peduncle longer than deep, expanded posteriorly.

Scales cycloid, very small, over whole body. Head apparently naked, but damaged. (On cheek, according to G. and B.'s fig., *loc. cit.*) Lateral line ascends to run parallel with dorsal profile, almost an eye-diameter below. l.l. about 125 (very approximately; G. and B.'s fig. shows 150).

Colour (preserved).—Uniform light brown. Fins light; dorsal, anal, and ventrals with darkish margin.

Length.—120 mm.

A single specimen from Durban, presented by E. C. Chubb, Esq., Curator of the Durban Museum.

There appears to be very little doubt that the present specimen should be assigned to *pellucidus*.

The specimen is not in very good condition, but most of the features may be discerned.

G. and B.'s figure shows a deeper body, more scales, a shorter snout, and the outer ventral rays longer than the inner. These differences are not significant, and may be due to the difficulty of observing accurately in so small a specimen as the type (about 60 mm. total length).

This species has been recorded from the Atlantic (32° N. × 76° W.) from a depth of 528 fathoms, and its presence in Natal waters is of interest.

Schedophilus medusophagus Cocco.

(Plate V, C.)

1876. Gunther, Challenger Rep., xxii, p. 46.

1895. Goode and Bean, Ocean Ichth., p. 214, fig. 223.

1902. Regan, Ann. Mag. Nat. Hist. (7), X, p. 196 (*Lirus m.*).

Body very compressed, ovate, extremely soft and pliable. Regions at bases of dorsal and anal, containing dermal rays, distinct and differentiated. Dorsal profile evenly convex. Snout slightly swollen, somewhat blunt. Interorbital strongly convex.

Depth 2·6, length of head 3·9 in length of body. Eye equal to snout and to interorbital width, 4·6, postorbital length 1·8, in length of head. Preorbital depth 1·7 in eye. Preopercle with flat spinules round angle. Traces of spines on interopercle. Remaining bones entire. Occiput and snout with thickened porous integument. Almost whole of head except operculum densely pitted with pores: radiating series round orbit. Nostrils close together, midway between snout tip and anterior margin of eye.

Gill-openings wide, membranes free. Rakers fairly long, 15 on lower part of anterior arch, longest slightly shorter than gill-filaments, 2 in eye. Rakers spinulose on basal half. Oesophagus with 14 papillate sacs. Vertebrae 42 (16 + 26).

Mouth large, slightly oblique; jaws equal. Maxilla extends to below behind centre of eye: upper margin slips, for the whole length, beneath the preorbital. Supplemental bone not obvious, maxilla not, or scarcely, expanded posteriorly. Teeth in a single comb-like series in each jaw, larger and smaller teeth alternating, larger teeth subspatulate. Palate and tongue edentate.

D 52, commences above hind margin of head. First few rays appear spinate, but all but tip is hidden in scaly skinny sheath. Rays increase gradually in length to the middle of the fin; there about 3 in head, remain subequal to the posterior, which are slightly shorter. The whole of the fin with a scaly, skinny basal investment; longest rays emerge for less than half of their length. Fin low, rays inclined obliquely backward, apparently not fully erectile.

A 35, commences below the 20th dorsal ray; shape of fin, length of rays, and skinny basal investment as for dorsal.

P 20, inserted very low, 2.2 in head, base not oblique. A scaly, skinny investment almost half of length of fin. Upper rays longer.

V I 5, inserted very slightly in advance of the pectorals, 3 in head. Last ray joined to belly by a membrane. Base of fin in scaly, skinny investment.

Caudal gently rounded, 1.7 in head. Peduncle as deep as long. Scales cycloid, fairly small. l.l. 135, very slightly curved anteriorly, becomes straight below the 12th dorsal ray, running obliquely down to peduncle. Whole of body and head, except interorbital and chin, scaly. A pore below almost every scale on body.

Colour.—Uniform brown (preserved).

Length.—230 mm.

A single specimen, found among fishes collected by S.S. "Pickle," labelled "Natal Fishes," unclassified, presented by the Director of the Government Fisheries Survey to the Albany Museum.

Regan (*loc. cit.*) regards *Schedophilus* Cocco as a synonym of *Lirus* Lowe, and states that *Lirus* has 25 vertebrae and a small supramaxilla. There is no doubt that the two genera are closely related, but the greater number of vertebrae of *Schedophilus*, as well as other minor features, would appear to justify the maintenance of this genus as distinct from *Lirus*. Meristic variation is alone of doubtful validity in defining genera, but since the other species of *Lirus* all presumably have 25 vertebrae, it would appear reasonable in this case. Further, I can find no signs of any supramaxilla in my specimen, nor is any mentioned in any description, or shown in any figure of *medusophagus* to which I have access.

It is with considerable doubt that the present specimen is assigned to *medusophagus*, since it differs in many significant features. The heavy dermal investment of the greater part of the dorsal and anal, as well as the

Marine Fishes of Seven Genera new to South Africa.

97

similar partial investment of the pectorals and ventrals, is not mentioned in descriptions of that species. Günther (*vide* G. and B., *loc. cit.*) states that the hinder dorsal and anal rays are not "erectile into the vertical position." This is true of my specimen, but the reason for this is the skinny sheath. Further, both dorsal and anal are longer, and there are more rays in the present specimen, but *medusophagus* is stated to vary widely in these counts, so that the present differences may not be of specific significance.

medusophagus has been recorded from the Atlantic and from Samoa. Its presence in Natal waters is of interest.

Family SCORPAENIDAE.

Setarches güntheri Johnson.

(Plate VI, C.)

1876. Günther, Challenger Rep., xxii, p. 19, pl. i, C (*fidjiensis*); p. 19 (*parmatus*).

1895. Goode and Bean, Ocean. Ichth., p. 263; p. 264, fig. 249 (*parmatus*).

Body moderately compressed, greatest width at nape. Head fairly depressed, interorbital almost plane. Depth 3.1, length of head 2.3 in length of body. Eye 6, snout 2.4, interorbital 4.5, and postorbital 2 in length of head. Head ridged and spinose. Preopercular stay prominent. Two long diverging spines on opercle. Suprascapula and coracoid exposed, each terminating in a flat spine. Three spines at angle of preopercle, slightly less than eye, the upper two on one side almost parallel (Pl. VI, A), the lower diverging: on the other side the three are equally divergent. Two others on lower margin, anterior smaller. Three preorbital spines projecting downwards over the maxilla. The anterior small and antrorse; the other two retrorse, graduated, the posterior the longer. Two low, flattened occipital spines, one similar postorbital spine, on each side. One antorbital spine projecting back over the eye, and one small retrorse nasal spine. Mouth large, somewhat oblique, maxilla highly expanded posteriorly, extends to below hind margin of orbit. Jaws subequal, no marked bony tubercle at symphysis of lower jaw. Upper jaw notched opposite symphysis. A narrow band of villiform teeth in each jaw. A chevron-shaped band, discontinuous at apex, of similar teeth on vomer. Similar teeth on palatines. The premaxilla has a supero-median expansion which slides under the maxilla. Premaxillary process short and curved. Nostrils tubular, close together, nearer anterior margin of eye than snout tip. Gill-openings wide, membranes free. Branchiostegals seven. Pseudo-branchiae present. Gill-rakers long, slender, 10 on lower part of anterior arch, anterior longest, almost equal to eye: gill-filaments short, about 3 in eye.

D XII 10, originates slightly in advance of hind margin of head. 1st spine equal to eye, then increase to the 4th, which is longest, 2.6 in head: thereafter decrease to the 11th, which is 6 in head. 12th spine more than twice 11th. Soft dorsal rounded, midrays longest, almost 2 in head.

A III 5, originates below the 3rd dorsal ray.

P 22, 1.3 in head, base fairly broad, extends to below the 4th dorsal ray. The upper ray and on one side 3, and on the other the 4 lower rays simple, the remainder branched. Ventrals 1.9 in head, do not reach vent; 1st ray longest.

Caudal almost truncate, 1.1 in head. Peduncle compressed, as deep as long, equal to eye.

Scales minute, cycloid. About 95 in lateral series. Lateral line raised, 26-27 perforations. Opercle and preopercle (above and below suborbital ridge) scaly. Rest of head naked.

Colour.—Light red-brown. Fins light.

Length.—190 mm.

Locality.—Presumably Natal, being found among fishes labelled "Natal Fishes," unclassified. Collected by S.S. "Pickle"; presented to the Albany Museum by the Director of the Government Fisheries Survey.

The three nominal species of this genus differ from one another only in unimportant details, and the types vary considerably in size. The type of *guentheri*, from Madeira, is 9 inches long; of *fidjiensis*, from the Fijis (315 fms.), 3 inches; while the type of *parmatus*, from New England (180 fms.), is only 2 inches in length, besides being damaged.

The spination of the cephalic bones is evidently variable. In my specimen the arrangement of the preopercular spines is on one side intermediate between the arrangement on the other and the arrangement in *guentheri*, in which they are stated to be parallel. The anterior (3rd) pre-orbital spine is not much exposed, and may not be obvious in the other specimens, especially in the smaller.

The differences in depth of body and in the relative sizes of the fins of the various species described can be explained by the difference in size between the specimens, and cannot be regarded as of specific significance.

Bathybial species are usually cosmopolitan, and the presence of this species in Natal waters, while of interest, is not in any way exceptional.

Family BATRACHOIDIDAE.

Batrachthys n.g.

Three lateral lines, each pore with minute cutaneous appendage above and below; middle line obscure. Jaws with tapering bands of small conical teeth. Larger teeth on vomer and palatines. Opercle with 2

spines. Subopercle with 2 spines; lower shorter, parallel or slightly divergent. Gill-opening fairly wide, extending from above the axil to below pectoral base. Gill-rakers few, short, obtuse or tubercular. Pharyngeal teeth equal or graduated in size. Three dorsal spines. Caudal free. No axillary foramen. Interorbital almost plane. Frontal ridges feeble. Vertebrae 29.

Genotype *albofasciatus* n. sp.

This genus is closely related to *Coryzichthys* Ogilby (from the Indo-Australian area), which is stated to have very restricted gill-openings, embracing only the upper half of the pectoral base, and the pharyngeal teeth are unequal in size. Ogilby (Ann. Queens. Mus., 1908, No. 9) * places *gangene* Ham-Buch. in *Coryzichthys*, despite the fact that Day's figure (Fishes of India, p. 269, pl. lx, fig. 1) shows this species to have gill-opening at least as large as the pectoral base. Day's figure (which is named *grunniens*, probably in error) shows 5 ventral rays, which must be erroneous, and he neither described nor figured any lateral line system.

There appears to be little doubt that *gangene* and the species described below are congeneric.

This genus differs considerably from the two genera, *Batrachoides* Lac. and *Marcgravia* Jord., the only two hitherto found in South Africa.

Batrachichthys albofasciatus n. sp.

(Plate V, B.)

Body robust, compressed behind. Head depressed, interorbital flat, skin slightly rugose. Depth 5.1, length of head 3 in length of body. Eye 5.5, snout 4, interorbital width 3.7, length of postorbital 1.6 in length of head. Six small barbels, about $\frac{1}{4}$ eye, on each side of chin, and one at hind end of maxilla, and one at each side of upper jaw opposite symphysis. Conspicuous mucus pores on head, each with a minute cutaneous appendage above. Two short fimbriate nasal tentacles. No supra-orbital tentacles. Mouth large, maxilla extends to below posterior margin of orbit. Small curved conical teeth in posteriorly tapering bands in both jaws. Six larger conical teeth across vomer, with 4 widely-spaced smaller teeth anteriorly. A single series of similar teeth on palatines. Pharyngeal teeth curved, conical, of uniform size on upper; posterior teeth on lower pharyngeals slightly larger than anterior, no marked inequality in size. Gill-membranes fused with isthmus, membrane expanded, fused with chest to below behind pectoral base. Gill-opening wider than the whole width of the pectoral base. Branchiostegals 5. Gill-rakers short, tubercular,

* I have not seen this paper.

apically dilated or bifurcated, 8 on lower part of anterior arch. Two acute opercular spines, upper larger, divergent. Two similar on subopercle, upper larger, almost parallel. Vertebrae 29 (12 + 17).

D III + 19, A 14. Soft dorsal and anal rays increase in length posteriorly, hind rays 2·5 in head.

P 18, 1·5 in head, base heavy, sublobate. No foramen.

Ventral 1·5 in head; spine in thickened skin.

Caudal rounded, 1·4 in head.

No scales. Three lateral lines. Upper and lower distinct, middle obscure, consisting each of a row of pores, each with a minute cutaneous appendage above and below. Upper runs from opercular margin up to the soft dorsal and along the base of the latter. The middle line curves down from the same origin as upper and runs along the middle of the side, becomes obsolete before anal origin. The lower runs from the lower margin of the pectoral base down to the origin of the anal, and then along the base of the latter.

Colour.—Brown, irregularly mottled with darker, and with dark spots on the body, head, and all fins. Five slightly sinuous white cross-bars, hinder 4 extending on to soft dorsal.

Length.—120 mm.

Locality.—Great Fish Point.

Type.—In the Albany Museum.

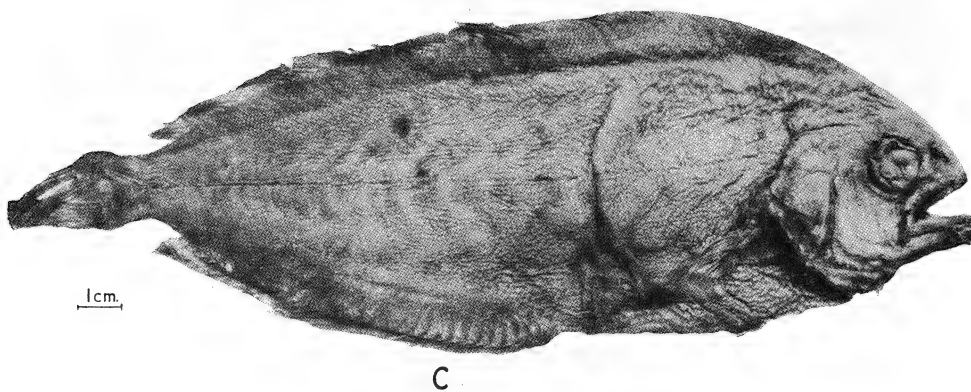
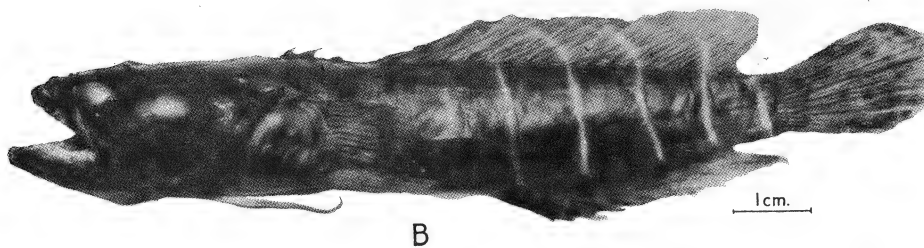
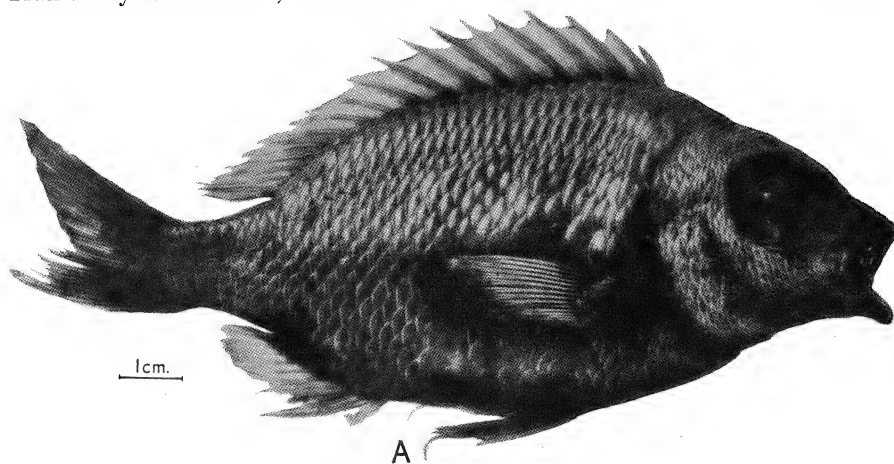
As indicated above, it is open to doubt whether this species should not be assigned to *Coryzichthys* Ogilby. The specimen described above is evidently bathybial, since it was thrown up after a storm at Great Fish Point, and the distended air-bladder was found to have filled almost the whole mouth.

While bathybial forms are generally more or less cosmopolitan, it appears preferable to retain this new genus until such time as the opportunity occurs to compare the genotype with Indian or Australian species.

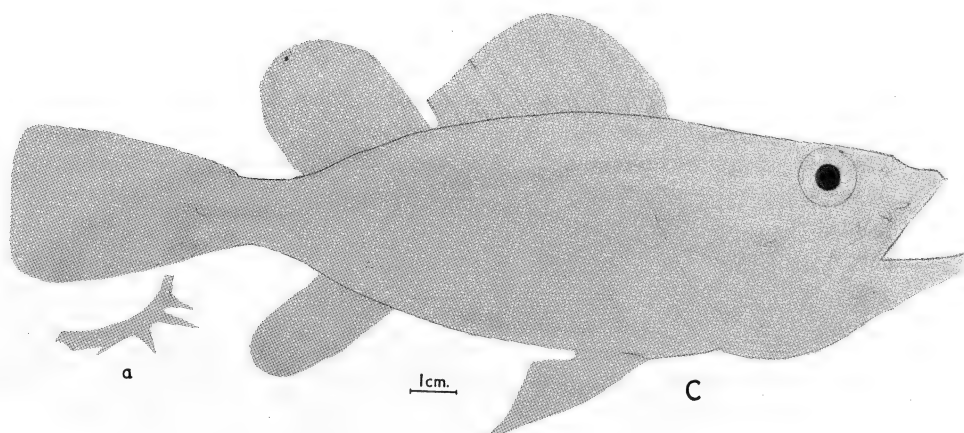
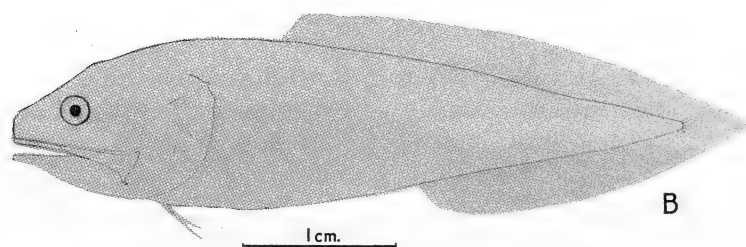
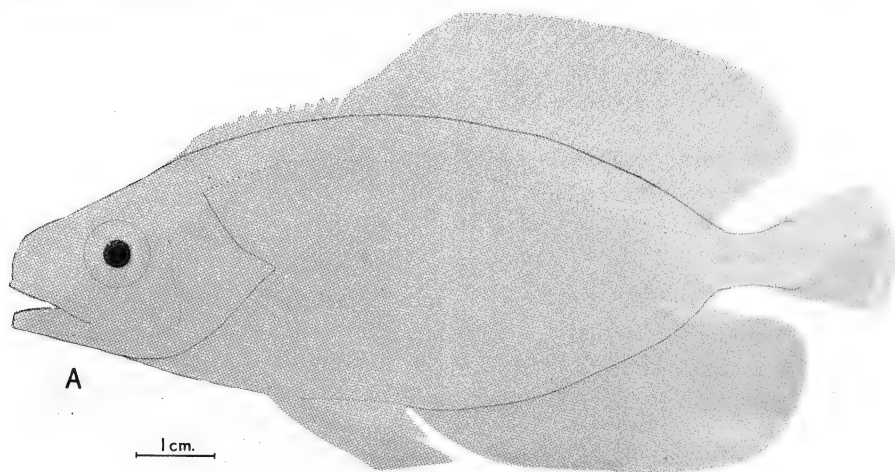
albofasciatus is very closely related to *gangene*, differing in fin formulae, in certain dimensional relationships, and in the absence of supra-orbital tentacles. This latter difference may prove to be sexual, and it is not unlikely that the two may prove to be conspecific.

I wish to express my gratitude to Dr. Barnard, Assistant Director of the South African Museum, for his kind assistance and for the loan of literature. Also to the Carnegie Research Fund (through the Research Grant Board of South Africa) for financial assistance.

ALBANY MUSEUM,
GRAHAMSTOWN,
October 1933.



A. *Scolopsis vosmeri* (Bloch.).
B. *Batrichthys albofasciatus* n.g. et sp.
C. *Schedophilus medusophagus* Cocco.



A. *Papyrichthys pellucidus* Lütken n.g.
B. *Grammonus opisthodon* n. sp.
C. *Setarches güntheri* Johnson.
a, Preopercular spines on left side.

Transactions of the Royal Society of South Africa. Vol. XXII.
Part IV. pp. 321–336. Pls. XVI–XXIII. December, 1934.

THE TRIGLIDAE OF SOUTH AFRICA.

By J. L. B. SMITH.

(With Plates XVI–XXIII and one Text-figure.)

(Read May 16, 1934. Revised MS. received June 18, 1934.)

FAMILY TRIGLIDAE.

Four genera of this family are admitted by Barnard (Ann. S.A. Mus., 1925, vol. xxi, p. 938) to the South African fauna list, viz. *Trigla* Art., *Peristedion* Lac., *Lepidotrigla* Gnthr., and *Chelidonichthys* Kaup.

An examination of the material in the collections of the South African Museum and of the Albany Museum indicated that a revision of the South African species of this family was necessary.

A new sub-genus of *Trigla*, *Trigloporus*, and three new species, are described below.

Key to the South African Genera.

- I. Lateral line without spines.
 - A. Scales small to moderate, less than 70 in lateral line *Lepidotrigla*.
 - B. Scales very small, more than 70 in lateral line *Chelidonichthys*.
- II. Lateral line spinose.
 - A. Body covered with bony plates, each bearing a spine.
 - Preorbitals produced *Peristedion*.
 - B. Body scaly. Preorbitals not produced. Whole body covered by a complex muciferous tube system.
 - Lateral line scales with several spines *Trigla (Trigloporus)*.

Genus LEPIDOTRIGLA Gnthr.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 938.

Body covered with scales of moderate size, ctenoid, or ctenoid above lower third of side, cycloid ventrally. Breast naked, or partly scaly. Lateral line bifurcates at caudal base, the branches extending on to the caudal lobes. Lateral line tubes with one long oblique dorsal and a similar ventral branch, and one to six intermediate smaller branches, each ending in a pore.

No spines on lateral line scales, which are somewhat larger than the

body scales, being vertically elongate. Teeth in jaws and usually on vomer; palatines edentate. Three free pectoral rays. A row of spinose plates along each side of the base of the dorsal fin.

This diagnosis, where amended, is based upon South African material only.

The species of this genus appear to be fairly numerous, but they have received relatively little attention from systematists, and the relationships do not appear to be well established.

Of the features upon which differentiation may be based, the number and nature of the preorbital spines appear to be of special significance, but these have apparently received little attention, and they have not been described as minutely as they merit. The shape of the spinous dorsal is also of assistance, but is evidently somewhat variable even in one species, *e.g.* in *natalensis* G. and T. the 3rd spine varies from 1.0–1.2 times the length of the 2nd. The number of serrae on the 1st dorsal spine may also prove of assistance in differentiation.

These fishes appear to be found below the 20-fathom line, and being of small size and relatively few in number, have at present no economic significance, in South Africa at least. All of our specimens have been obtained in Natal waters, and may ultimately be found in other parts of the Indo-Pacific area.

The South African species first obtained and described by Gilchrist and Thompson (Ann. S.A. Mus., 1914, vol. xiii, pp. 75, 76) were *faurei* and *natalensis*. Barnard (Ann. S.A. Mus., 1925, vol. xxi, p. 938) later united these species under *faurei*, which has page-preference over *natalensis*.

A careful study of the material believed to have been used by the original authors reveals that *natalensis* should be revived, but chiefly upon features not noticed by Gilchrist and Thompson. As will be shown below, it is not indeed certain that the specimen now described as *faurei* is one of those described by the original authors.

A new species, *multispinosus*, well differentiated from our and from other Indo-Pacific species, has been added.

Key to the South African Species.

- I. No keel on preopercle. Six or fewer preorbital spines. Pectorals longer than head.
 - A. A patch of scales on breast. Two outer preorbital spines abruptly longer than the subequal inner spines *faurei*.
 - B. Breast naked. Two outer preorbital spines not abruptly longer than the graduated inner spines *natalensis*.
- II. A strong keel on lower margin of preopercle. Ten or more spines on each preorbital. Pectorals shorter than head *multispinosus*.

In the following descriptions "length of head" is the distance from the hind margin of the upper portion of the opercular flap (*i.e.* excluding the projecting portion of the opercular spine) to the tip of the longest preorbital spine. This is in most cases practically the same as the distance from the hind margin of the opercular flap to the mid-point of the snout between the preorbital extensions, measured obliquely.

Total length is measured from the tip of the longest preorbital spine to the apex of the mid-caudal rays.

Lepidotrigla faurei G. and T.

(Plate XVI, A; Plate XVIII, A; Plate XIX, A, C.)

1914. Gilchrist and Thompson, Ann. S.A. Mus., vol. xiii, p. 75.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 938.

Depth 4.1, length of head 3.1 in length of body. Eye 3.9, interorbital 4.9, snout (to tip of preorbital spine) 2.6, distance between apices of longest preorbital spines 3.5 in head. Dorsal profile of snout steep, almost straight. Snout between the projecting preorbitals scarcely emarginate. Preorbitals each with 6 spines, the outer 2 large, subequal in length, the inner 4 subequal, very abruptly smaller than the outer (Pl. XVIII, A). No preopercular spine or keel. Two inconspicuous spines on supero-anterior margin of orbit. A short transverse groove at the supero-posterior margin of each orbit. Nuchal spines feeble, reach beyond the base of the 3rd dorsal spine. Opercular and humeral spines moderate. Jaws with bands of small conical teeth. Vomerine teeth doubtful. Palatines edentate. Pyloric caeca cannot be determined as the intestines have decomposed. Seven gill-rakers plus several rudiments.

D VIII+16, inserted above the hinder third of the opercular flap. 1st, 2nd, and 3rd spines serrate, 38 serrae on 1st spine, those on 3rd spine very small. 1st spine 2.0, 2nd 1.7, 3rd 1.6 in length of head. 4th-6th dorsal rays longest; 5th ray 1.9 in head, 5.7 in length of body; 14th ray 2.3 in head, 7.0 in length of body. 14th ray laid back just reaches upper margin of caudal base.

A 16, inserted below the soft dorsal origin. Lower than soft dorsal.

P 11+3, 1.13 times head, 2.75 in length of body; tip reaches to below the base of the 7th dorsal ray, and to below the 29th lateral line scale. First upper and lower three of connected rays simple. Longest free ray 1.3 in head, tip does not reach ventral tip.

Ventrals 1.2 in head, reach to base of 3rd anal ray.

Caudal slightly emarginate, peduncle 1.4 times eye.

Scales moderate, ctenoid dorsally to level of humeral spine, graduated into cycloid on ventral area (Pl. XIX, A and C). Lateral line scales 60;

tubes with 3–8 branches, longest above and below. No pores on body. 22 spines along dorsal base. Breast with a median patch of moderate cycloid scales.

Colour.—Preserved, uniform red-brown. Inner surface of pectorals dark, with light margin above and below.

Length.—143 mm. (S.A. Mus., No. 11803).

Locality.—Natal, off Tugela mouth, in 20–63 fathoms.

In the South African Museum are eight adult specimens of *Lepidotrigla*, these having been registered as the material, collected by the s.s. “Pieter Faure,” upon which Gilchrist and Thompson based their diagnoses of *faurei* and of *natalensis*. These eight specimens have the following numbers, lengths, etc.:—

S.A.M. No. .	11797	11797	11797	11803	11812	11812	11812	11812
Total length .	178	174	160	143	167	162	155	135
Body length .	154	149	134	120	144	136	130	120
Dorsal spines .	9	9	8	8	9	8	8	8

According to the South African Museum register, two of the three of No. 11797, plus No. 11803, are Gilchrist and Thompson’s orthotypes of *faurei*, and one of those of No. 11812 is the holotype of *natalensis*.

According to Gilchrist and Thompson (*loc. cit.*), the three types of *faurei* were of length 120 mm., 120 mm., and 146 mm. None of the above are as small as 120 mm., unless these authors recorded body and not total length. Otherwise, some of their measurements were erroneous, or there has been a loss of specimens.

In the case of *natalensis* the holotype was stated to be 120 mm. in length, and it is possibly the smallest of those of No. 11812. In any case, there has obviously been some lack of care in the designation and preservation of Gilchrist and Thompson’s orthotypes, which is particularly regrettable in the present case, since a careful study of the eight specimens reveals that No. 11803 is well differentiated from the remaining seven, which are undoubtedly conspecific.

The original descriptions of *faurei* and of *natalensis* reveal nothing of significance whereby these two species may be distinguished from each other. *L. faurei* was stated to have “two strong spines” on each pre-orbital, and ctenoid scales, and *natalensis* to have “a row of strong spines” on each preorbital, and cycloid scales.

None of the eight South African Museum specimens have only two preorbital spines, but in No. 11803 the two outer are very abruptly longer than the subequal inner spines (Pl. XVIII, A). In none of the remaining

seven specimens are the two outer spines so abruptly differentiated from the inner (Pl. XVIII, B and C). Further, in all of the specimens, the scales above the lateral line are ctenoid, but cycloid on the ventral surface.

It is therefore impossible to select with certainty the orthotypes of Gilchrist and Thompson, but there is no alternative except to revive *natalensis*. In view of the nature of the preorbital spines of No. 11803, this (a ripe female) is here designated the holotype of *faurei*, and the remaining seven specimens (male and female) listed above may be designated the lectotypes of *natalensis*, or, alternatively, No. 11812 of length 135 mm. might be selected as the orthotype.

L. faurei is well differentiated from *natalensis* not only by the nature of the preorbital spines, but also by the presence of scales on the breast, and by the longer pectorals and soft dorsal rays. The scales of *faurei* are more strongly denticulate than equivalent scales of *natalensis*.

It is, however, remarkable that among over 50 juvenile specimens, taken with these eight adults, none show any signs of a scaly breast, and should no further specimens of *faurei* (as here defined) be discovered, it may be suspected that it is merely an abnormal specimen of the form now recognised as *natalensis*.

Lepidotrigla natalensis G. and T.

(Plate XVI, B; Plate XVIII, B, C; Plate XIX, B, D, E, F.)

1914. Gilchrist and Thompson, Ann. S.A. Mus., vol. xiii, p. 76.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 938 (*faurei* part?).

Depth 4.0-5.0, length of head 3.0-3.2 in length of body. Eye 3.4-4.0, interorbital 4.0-5.0, snout (to tip of preorbital spine) 2.2-2.5, distance between apices of longest preorbital spines 3.2-3.7 in head. Dorsal profile of snout steep, almost straight. Snout between the projecting preorbitals almost straight to emarginate. Preorbitals each with 4-6 spines, the outer the largest, graduated to the inner, no abrupt change in size (Pl. XVIII, B and C). The form and arrangement of these spines are somewhat variable, and some specimens have 1-2 outer smaller spines at the base of the largest. In very young specimens there are rarely more than 2-3 spines visible, and these are highly incurved, as if the spinose preorbital extension develops from the inner side with growth. No marked preopercular spine in adults; a small pungent spine in very young specimens, which becomes more or less obsolete with growth. No preopercular keel. Two inconspicuous spines on supero-anterior margin of orbit; there are 2-3 moderately prominent spines in juveniles which diminish with growth. A short transverse groove at the supero-posterior margin of each orbit, obscured on one or both sides in some specimens by an outgrowth of the

bony integument. Nuchal spines fairly strong, reach from almost below to beyond the base of the 3rd dorsal spine. Opercular and humeral spines moderate.

Jaws and vomer with bands of small conical teeth. Palatines edentate. Gill-rakers 7-9 plus several rudiments. Pyloric caeca 6-8.

D VIII-IX + 16, inserted above the hinder third of the operculum. 1st, 2nd, and 3rd spines serrate, 42-46 serrae on first spine, those on 3rd very small. 1st spine 1.7-2.1, 2nd 1.6-1.8, 3rd 1.5-1.7 in length of head. 3rd spine 1.03-1.2 times second. 4th-6th dorsal rays longest; 5th ray 2.1-2.5 in head, 6.2-7.0 in length of body. 14th ray 2.6-2.7 in head, 8.0-8.6 in length of body. 14th ray when laid back does not reach the upper margin of the caudal base.

A 16, inserted below origin of soft dorsal, shape similar to that of soft dorsal, but rays shorter.

P 11 + 3, 1.0-1.08 times head, 3.0-3.2 in length of body, tip reaches to below the base of the 3rd-5th dorsal ray, and to below the 24th-25th lateral line scale. First upper and lower three of connected rays simple. Longest free ray 1.4 in head, does not reach ventral tip.

Ventrals 1.1-1.2 in head, reach origin of anal or just beyond.

Caudal slightly emarginate, peduncle 1.2-1.4 times eye.

Scales moderate, weakly ctenoid dorsally to level of humeral spine, graduated into cycloid on ventral area (Pl. XIX, B, D, and E). Lateral line scales 58-61, tubes with 3-6 branches, with longest above and below (Pl. XIX, F). Sometimes a few pores on body, most marked ventrally, occasional scales perforated. 23-25 spines along dorsal base. Breast naked.

Colour.—Preserved, uniform red-brown. Inner portion of pectorals dark with light margin above and below.

Length.—35-178 mm.

Locality.—Natal, off Tugela mouth, up to 63 fathoms.

Lepidotrigla multispinosus n. sp.

(Plates XVII and XX.)

Dorsal profile of snout undulate, abruptly descending, concave before eyes, convex on anterior part, with abrupt descent at tip. Depth 4, length of head 3.1 in length of body. Eye 4.0, interorbital 4.8, snout 2.0, postorbital part of head 3.1 in length of head.

Rostrals, with slight, widely diverging, medio-longitudinal ridge, length 11 in head (measured between parallels of mid-point of snout and tip of process). At the apex are small spines, mostly invested; on the left process there are 5 small outer spines and 12 inner, the first (outer)

of the 12 by far the largest; on the right are 10 spines, with the outer longest (Pl. XVII, C). Distance between the apices of the longest rostral spines 3 in head. Lateral keel of preorbital very faint, ending below and not continuous with the preopercular ridge. A distinct ridge on lower margin of preopercle, 1.3 times eye, slightly oblique downwards to the angle, at which there is no spine. Two weak spines above the anterior part of the orbit; one larger above the hind margin. On each side one weak occipital, and two nuchal spines, the hinder the larger; apex of this just reaches the base of the 3rd dorsal spine. Interorbital deeply concave. The granules on the cheek radiate fan-wise backwards from below the front margin of the eye; similarly on the opercle from the base of the spine. On the preorbital the arrangement is irregular. A short deep groove at the supero-posterior margin of the orbit continuous, angularly bent backwards across the occiput. Humeral spine 3, free distal portion 6 in head.

Mouth sub-inferior, lower jaw included, maxilla 2.6 in head. Villiform teeth in bands in both jaws, wider in upper jaw. Vomerine teeth doubtful. None on other bones. Tongue adnate. Large pores on lower surface of mandibles. No barbels. Branchiostegals 7. Membranes free from isthmus. Gill-rakers 5, longest 5 in eye, plus 4 anterior rudiments. Pyloric caeca 6, moderate.

D VIII + 15, inserted above the hind margin of the operculum. 1st spine 2.1, 2nd and 3rd subequal, 1.8 in head. 1st spine with 24 anterior spinules, 2nd and 3rd weakly spinate. Base of 1st dorsal 1.8 in head. Longest soft ray (5th–8th) 3.5 in head. Base of soft dorsal 1.1 times head. On one side 23, on the other 25 spines below the dorsal.

A 16, originates below the origin of the soft dorsal.

P 11 + 3, 1.2 in head, reaches to below the base of the 7th dorsal ray. Longest (upper) free ray, reaches almost to ventral tip, 1.4 in head.

V I, 5, reach to base of 3rd anal ray.

Caudal almost truncate, peduncle twice eye.

Scales (mostly shed) relatively small, ctenoid to below the pectoral base, ventral scales with a single large denticle (Pl. XX, A, B, and C). l.l. 59. Each tube with an upper and a lower oblique branch, and from one to four smaller intermediate branches, each ending in a pore (Pl. XX, D). Breast naked.

Colour.—Preserved, uniform red-brown. Pectorals dark.

Length.—160 mm.

Type in the Albany Museum.

This specimen was among certain fishes presented to the Albany Museum by the Director of the Government Fisheries Survey. It was without serial number or locality, although probably from Natal.

It is very clearly distinct from our other species, the preopercular keel,

the number of the preorbital spines, the long peduncle, the smaller scales, and the relatively short 3rd dorsal spine being distinctive features. This species appears to be well differentiated from all others by several features, notably the deep excavation between the long multidentate preorbital extensions and by the preopercular keel.

Genus CHELIDONICHTHYS Kaup.

1925. Barnard, *loc. cit.*, p. 939.

Scales very small. Three free pectoral rays. Palatines edentate. A row of spinose plates along the base of the dorsal fin. Lateral line without spines, bifurcating at the caudal base. Preorbitals produced into spines.

Europe, Africa, Japan, and Australia.

This genus appears to be quite valid, but is apparently not recognised by some systematists.

As far as the South African species are concerned, Barnard's treatment requires no revision, the descriptions being in the main accurate and detailed, and the differentiations clearly defined.

Key to the South African Species.

- I. Breast naked. Preorbitals ending in several (usually incurved) spines.
 - A. Eye not greater than interorbital width *capensis*.
 - B. Eye distinctly greater than interorbital width *kumu*.
- II. Breast pitted. Preorbital ending in one large straight outer spine, with inner concealed fused spines *queketti*.

capensis C. and V. appears to be well differentiated from any European species, as indicated by Barnard (*loc. cit.*). This species is of moderate economic significance as a food-fish in South Africa.

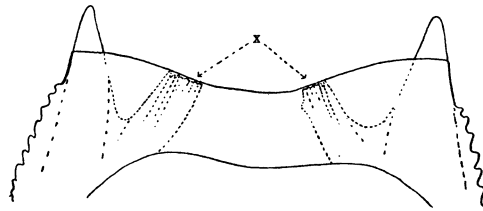


FIG. 1.—Preorbital spines of *Chelidonichthys queketti* Rgn.

X = Inner fused spines, concealed by membrane.

Barnard (*loc. cit.*) has compared our specimens of *kumu* L. and G. with Australian specimens, and his opinion that they are conspecific is here accepted.

queketti Rgn. is apparently an endemic species. Previous workers do not appear to have noticed that, besides the large outer preorbital spine,

there is on each side, concealed within the basal skinny membrane, an inner process, which has obviously been produced by the coalescence of from four to eight smaller spines (fig. 1).

Genus PERISTEDION Lac.

1895. Goode and Bean, Ocean Ichth., p. 470.
 1913. Weber, Siboga Exp. Monogr. 57, p. 511.
 1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 944.

Body covered with bony plates, each bearing a spine. Mouth inferior, lower jaw included, with barbels on the lower margin, the outer the longest. Each preorbital greatly enlarged and produced forwards as a spatuliform process, with lateral keel continuous along lower margin of preopercle, which ends in a spine. No teeth. Dorsal single or divided. Two free pectoral rays.

Two species have been found in our area, *adeni* Lloyd, and what has hitherto (though with doubt by Barnard, *loc. cit.*, p. 946) been accepted as *gracile* G. and B. This latter species has now been found not to be conspecific with *gracile*, and is here described as *weberi* n. sp.

Many other species will doubtless be found in our area with more intensive collecting, and it is not unlikely that at least some of the relatively numerous Indo-Pacific forms will be among them.

Key to the South African Species.

- I. No spines on dorsal surface of snout. l.l. 34 *weberi*.
 II. One median and 4 smaller spines on dorsal surface of snout. l.l. 30 *adeni*.

Peristedion weberi n. sp.

(Plate XXI.)

1924. Gilchrist and von Bonde, Fish. Mar. Surv. spec. Rep. iii, p. 22
 (*gracile*).
 1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 945 (*gracile*?).

Dorsal profile abruptly descending before upper half of eye, thereafter slopes more gently. Depth 5.4 (5.0), length of head including rostral process 2.4 (2.1), rostral process 8.5 (7.5) in length of body. (The figure in brackets gives length in distance from base of caudal to tip of maxilla.) Eye 5.5 (4.2), snout 2.9 (2.2), snout plus rostral process 1.6 (1.2), rostral process 3.5 (2.7), interorbital width 6.5 (5.0) in length of head (including rostral process; the figure in brackets is length in length of head without rostral process).

Interorbital deeply concave, supraorbital ridge moderate, terminating

in a flat spine, followed by two retrorse spines. A small serrated suborbital keel terminating in a feeble blunt spinose projection. The widely diverging rostral processes are continued backwards as serrated ridges, each terminating at the angle of the preopercle, hind margin scarcely acute (Pl. XXI, B and C). No nasal or frontal spines. No spine at base of rostral process. Numerous pores on head and along lower edge of mandible. 8-9 groups of bi- or trifid barbels on each side of the lower jaw, longest fimbriate, equal to orbit. (Pl. XXI, A, pencilled in on photograph.)

Maxilla 1.5 times eye. No teeth in jaws or on palate. Tongue adnate. Gill-rakers 20, longest 2.5 in eye. 30 spinose plates on dorsal, 28 on ventral surface. The anterior ventral plates are 2.3 times as long as broad, *i.e.* the width of the two plates is 1.15 in the length of one plate (Pl. XXI, D). A rectangular portion of the second plates, five times wider than long, fits into a recess in the anterior plates.

D VIII, 20, originates an eye-diameter behind eye, above the hind margin of the operculum. 4th spine longest. 1st spine 3.5, 2nd and 3rd subequal 3.2, 4th 2.9 in length of head (without rostral process). 1st ray 5.4, 2nd 4.3, 3rd 3.6, 4th-8th longest 3.2 in length of head (without rostral process); thereafter the rays decrease.

A 20 (or I, 19), inserted below the base of the 4th dorsal ray. Shape and length of rays as in dorsal. Base of anal 5.6 times longitudinal diameter of eye.

P 11 + 2, 2.2, longer detached ray 1.6, lower 1.8 in head (without rostral process). Upper detached ray reaches well beyond ventral tip. Ventrals 1.9 in head (without rostral process) reach to vent. Membrane for half-length of last ray joined to body.

Caudal emarginate, mid-rays 1.1 times eye.

The lateral line descends abruptly from the shoulder to the middle of the side. 34 spinose plates in the lateral line, 4 of these on the downward portion. Lateral line tubes bifurcate, ending in a pore above and a pore below the spine (Pl. XXI, E). The spines on the anterior 23 plates are simple, those on the 11 posterior plates have an anterior antrorse and a posterior retrorse point (Pl. XXI, E).

Colour.—Preserved, uniform light brown. Traces of dark mottling on distal half of pectoral.

Length.—185 mm.

Locality.—Off Delagoa Bay, in 260 fathoms.

Type in the Albany Museum.

A single specimen, labelled *P. gracile* G. and B., presented to the Albany Museum by the Director of Fisheries Survey.

According to the Fisheries Survey records (Mar. Bio. Rep., 1921 (2), p. 10), 8 specimens, subsequently identified as *Peristedion gracile* G. and B.

The Triglidae of South Africa.

331

(Gilchrist and von Bonde, Mar. Bio. Rep., 1924, iii, p. 22), were obtained off Delagoa Bay, in 260 fathoms; the specimen described above was one of these.

Barnard (*loc. cit.*, p. 947) was very doubtful of the validity of this identification, chiefly because *gracile* is a Mexican species. This has led me to make a critical examination of the specimen in the Albany Museum.

The original description of *gracile* (Goode and Bean, Ocean. Ichth., 1896, p. 473, fig. 387) is based upon a single type specimen about 125 mm. in length. (There are several discrepancies in this description.)

Although reasonably close to *gracile*, the specimen described above is evidently not conspecific. The shape of the spinous dorsal, the longer anal base, the bispinose posterior lateral line plates, and the number of plates, as well as the ridge below the eye, all distinguish the present specimen from *gracile*. There are also fewer gill-rakers, but Goode and Bean may possibly have given the number (26) on the whole arch. The original description of *gracile* does not say whether the rostral processes are divergent, but the two species have much in common. This is another case of remarkably close relationship between Indo-Pacific and Atlantic species.

weberi is also related to *rivers-andersoni* Alcock, and to *nierstraszi* Weber, from the Indo-Pacific. I have seen only the original description and figures of the former species (Alcock, 1894, J. Asiat. Soc. Bengal, lxiii, pt. 2, p. 12, pl. vi, figs. 2, 2a, 2b). Dr. de Beaufort of Amsterdam has kindly lent me one of the co-types of the latter species. An examination of this indicates that *nierstraszi* is of doubtful validity, since the specimen agrees in most particulars with the description of *rivers-andersoni*, especially if the difference in size between the types of the two species be taken into account, *e.g.* the posterior lateral line plates of this specimen of *nierstraszi* are bispinose, and there is a small but distinct spine on the dorsal surface of the base of each rostral process.

Since I have not seen a specimen of *rivers-andersoni*, I cannot venture to state that *nierstraszi* is conspecific, although it appears quite possible.

In any case *weberi* is quite definitely distinct from either, in the nature of the more slender and diverging rostral processes alone.

In regard to *gracile*, it would not indeed be surprising if a re-examination of that species showed that *weberi* is even more closely related than appears here. It is highly probable that *gracile* actually has bispinose posterior lateral line plates.

Peristedion adeni Lloyd.

(Plate XXII.)

1907. Lloyd, Rec. Ind. Mus., vol. i, p. 8.

1908. Alcock, Illustr. Zool. Invest. Fishes, pl. xliii, figs. 1, 1a.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep. iii, p. 78.

1925. Barnard, *loc. cit.*, p. 945.

? 1925. Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxvii, p. 256.

Dorsal profile of snout gently sloping before eye, scarcely concave. Depth 5.1, length of head (without rostral process) 2.6, (with rostral process) 2.2 in length of body (without rostral process). Eye 5.5, interorbital width 4.7, snout (with rostral process) 1.4, (without rostral process) 1.7, rostral process (broken) about 6 in length of head (excluding rostral process).

Interorbital moderately concave, supraorbital ridges moderate, with a moderate spine on the posterior margin. On each side of the nape a large spine, and a smaller one below. One median frontal spine. On each side one small antorbital and one small nasal spine. The preorbital process is large, flattened, with inner edges subparallel, outer margins converging; the outer margins produced meet at an angle of 30°. Width of process at base 1.2 in eye. The lateral edge of the preorbital process is continued backwards as an undulate keel, terminating in the large preopercular spine (Pl. XXII, B). There is a short and narrow suborbital keel.

Mouth large, maxilla 2.2 times eye. No teeth, tongue adnate. On each side of the lower jaw there are 7-8 single small barbels, and one large outer, fimbriate, 2.8 times eye. Gill-rakers 17, longest 3 in eye, anterior rakers short but graduated.

21 spinose plates on ventral, 24 on dorsal surface. The anterior ventral plates are together 1.1 times wider than the length, *i.e.* each plate is 1.8 times longer than wide (Pl. XXII, C). 2nd plates each slightly wider than long. A quadrangular portion of the 2nd plates, five times wider than long, fits into a recess in the anterior plates.

D VII + 15, inserted above hind margin of opercle, 3rd spine longest, 3.1 in head (without rostral process). 18 spinose plates along base.

A 15, inserted below the base of the 2nd dorsal ray, base five times longitudinal diameter of eye.

P 11 + 2, 1.9, upper detached ray 2.6 in head (without rostral process). Tip of pectorals reaches to below the 11th lateral line plate.

Ventrals 2.0 in head (without rostral process), just reach vent. Membrane joined to body.

Caudal damaged.

The lateral line descends abruptly from the shoulder to the middle of the side. 30 lateral line plates, 5 of these on the downward portion. The anterior 20 unispinose, the next 7 bispinose, and the last 3 unispinose (Pl. XXII, D). The lateral line pores do not show externally.

Colour.—Preserved, uniform light brown, pectorals darker.

Length.—About 225 mm.

Locality.—Natal.

A single specimen (S.A.M., No. 16223, from Mr. Bell Marley).

The specimen described above was identified as *adeni* Lloyd by Dr. Barnard (*loc. cit.*), with which identification I am provisionally in agreement.

There are, however, certain variations from the original diagnosis, the most marked of which is the presence of the mid-posterior bispinose lateral line plates. These are not as obvious as in the species (*weberi*) previously described, and may have escaped notice.

The original description makes no mention of the antorbital and nasal spines. Barnard (*loc. cit.*) mentions these, but does not draw attention to the fact that they were not present in the type diagnosis.

In this specimen the outer margins of the preorbital processes would meet at a more acute angle than those of the type, *i.e.* they are less markedly convergent, but this feature is not of importance, and might vary considerably. Further, there is no mention of the suborbital keel which is present in this specimen.

These combined differences might, if established, justify the separation of the present specimen from *adeni*, but as I have not access to any type of that species, it would be unwise to venture this step.

Genus TRIGLA Art.

1925. Barnard, *loc. cit.*, p. 943.

Body covered with very small scales, ctenoid above, cycloid on ventral surface. Three free pectoral rays. Lateral line scales spinose. A row of spinose plates along the base of the dorsal fin. No palatine teeth. Lateral line bifurcates at the caudal base.

Trigloporus new sub-genus.

Distinguished from *Trigla* (*sensu stricto*) by the whole body (excepting the chest) being covered with a complex system of reticulate tubes (each ending in a pore), between rectilinear transverse multiporose tubes, as well as by the multispinate nature of the lateral line scales. The pectorals are also probably longer than in *Trigla* (*Trigla*).

Europe and Africa.

Genotype, *africana* n. sp.

This sub-genus is proposed with considerable doubt as to its validity, since I have seen, besides *lineata* Gmel., only one other European species of *Trigla* (*sensu lato*), viz. *gurnardus* Linn. The extraordinarily highly developed mucus canal system of *lineata* and of *africana* (which are clearly congeneric in all respects), as well as the spination of the lateral line scales, would appear to justify full generic distinction of the latter two species

from *gurnardus*. Against this, however, is an account of the species of *Trigla* by Smitt (Skand. Fish., 1892, pt. 1, p. 194), of which I have seen a brief abstract, in which he states that the species of this genus show practically all stages of development of the mucus canal system intermediate between that of *gurnardus* and that of *lineata*. Despite this, the difference between these species is very striking, but since material to establish or refute the absolute accuracy of Smitt's statement is not available, as a compromise, *Trigloporus* is proposed as a sub-genus of *Trigla*.

Trigla (Trigloporus) africana n. sp.

(Plate XXIII.)

1925. Barnard, *loc. cit.*, p. 943 (*lineata* Gmel.).

Dorsal profile of snout fairly steep, gently concave. Depth 4·5–5, length of head 3·5–3·7 in length of body. Eye 4·3–4·5, interorbital 4·0–4·5, snout 2·2, postorbital part of head 2·5, preorbital depth 2·4–2·5 in length of head (measured from the hind edge of the operculum at the spine to the snout tip). Front of snout rounded, or with slight median concavity. The preorbitals are not produced, and there are no obvious spinules. Interorbital deeply concave. Two to four backwardly radiating antero-supraorbital ridges, each ending above the orbital margin in a small spine. One to three minute supero-postorbital spinate ridges, without any cross groove behind. One to three nuchal spines, the infero-posterior the longest, just reaches below the base of the 1st dorsal spine. Humeral spine very short, apex reaches beyond the hind margin of the operculum, a distance equal to 5·5–6·2 in head. No keel on preorbital, the lower edge of which is scarcely serrate. One set of backwardly radiating granules from anterior margin of preorbitals; three radiating sets on cheek, lower above end of maxilla, median largest in centre of cheek, and a smaller group below hind margin of eye. Preopercular and opercular spines very feeble.

Maxilla extends to below the hind margin of the eye. No vomerine teeth. The pores on the lower surface of the rami are arranged in 5–6 more or less regular longitudinal series, close set, but not aggregated into groups.

D X + 15–16, inserted above slightly in advance of hind margin of operculum. 1st spine 1·4–1·5, 2nd, longest, 1·3–1·4, 3rd 1·4–1·5 in head. 1st spine with a few rudimentary spinules or granules on the lower anterior edge. Soft rays 2·5 in head.

A 15–16, inserted below the soft dorsal, rays similar to dorsal.

Pectorals 1·25–1·3 times head; tip reaches to below the 4th–5th dorsal

ray. Longest free ray 1.1–1.2 in head, tip reaches to the posterior third of the ventral.

Ventrals 1.0–1.2 times head, reach to the base of the 2nd–4th anal ray.

Scales very small, strongly ctenoid above the lateral line (Pl. XXIII, C), grade into cycloid on ventral surface. The whole of the body is covered with the reticulate system of mucus canals described earlier, the transverse rectilinear tubes resembling lateral folds of the skin between the scale rows (Pl. XXIII, B). 67–70 scales in the lateral line, each scale bearing 2–5 spines, each much smaller than the single spine on the lateral line scales of the species *gurnardus* Linn. Breast partly or wholly scaly.

Gill-rakers 7–8. Pyloric caeca 7–9.

Colour.—Red-brown, mottled and spotted, with 4–7 faint cross-bars. Spinous and soft dorsal and caudal with irregular blotches. Ventrals reddish. Pectorals bluish, with irregular cross-mottlings; free rays with several brownish blotches.

Length.—Up to 230 mm.

Localities.—Cape St. Blaize, 26–33 fathoms; Algoa Bay, 40 fathoms; Port Alfred, cast up on the shore.

Holotype, from Port Alfred, in the Albany Museum.

The South African specimens have hitherto been regarded as identical with the European species *lineata* Gmelin.

Since I had access to no recent detailed descriptions of that species, I forwarded a specimen of our species to Mr. Norman of the British Museum, requesting him to compare it with the European form, and, if there appeared any doubt of conspecificity, to send me material for comparison. He has kindly sent this, and there appears to be little doubt that the South African species is well differentiated.

The following table indicates some of the numerous features by which the two species are differentiated:—

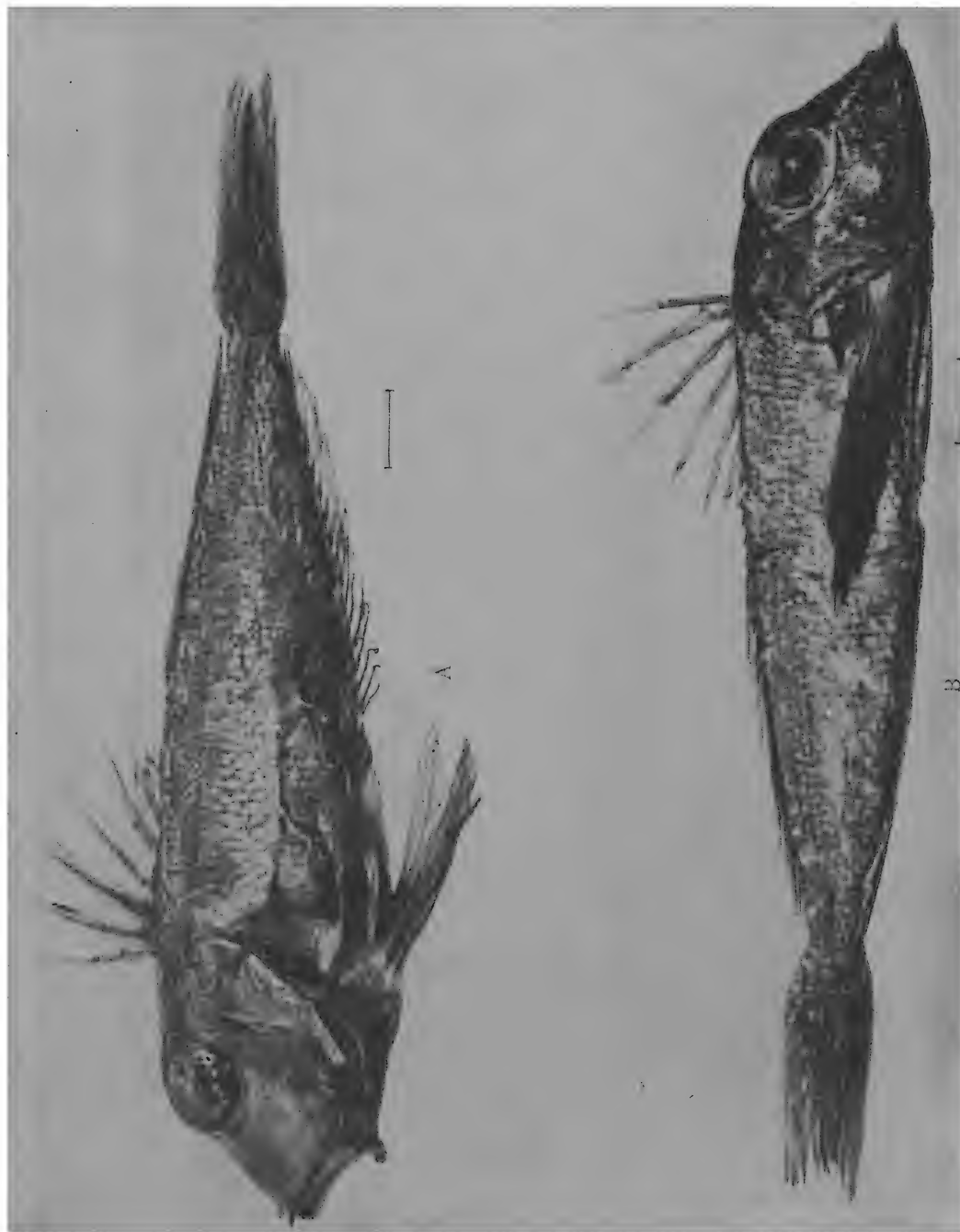
	<i>lineata</i>	<i>africana</i> .
Pectoral times head . . .	1.6	1.2–1.3
Humeral spine in head . . .	3.4	5.5–6.2
Eye in head	3.4	4.3–4.5
Pores on rami	In groups of 5–6	In uniform rows
Breast	Naked	Scaly
Lower margin of preorbitals . . .	Serrate	Smooth
Dorsal spines	12	10
Anterior margin of first dorsal spine	Serrate whole length	Feebly serrate basally

336 *Transactions of the Royal Society of South Africa.*

Besides these, the dorsal profile of the snout of *lineata* is much steeper, and the angle subtended by the corners of the mouth at the symphysis is much less than in our species, while the spination and granulations on the head of *lineata* are much more marked than in *africana*, and the spinous dorsal is markedly larger.

I wish to express my gratitude to Dr. Barnard, Assistant Director of the South African Museum, for the very considerable assistance he continually affords me in providing extracts from literature not available here, as well as for freely lending material from the South African Museum collection. Also to the Carnegie Research Fund, through the Research Grant Board of South Africa, for generous financial assistance.

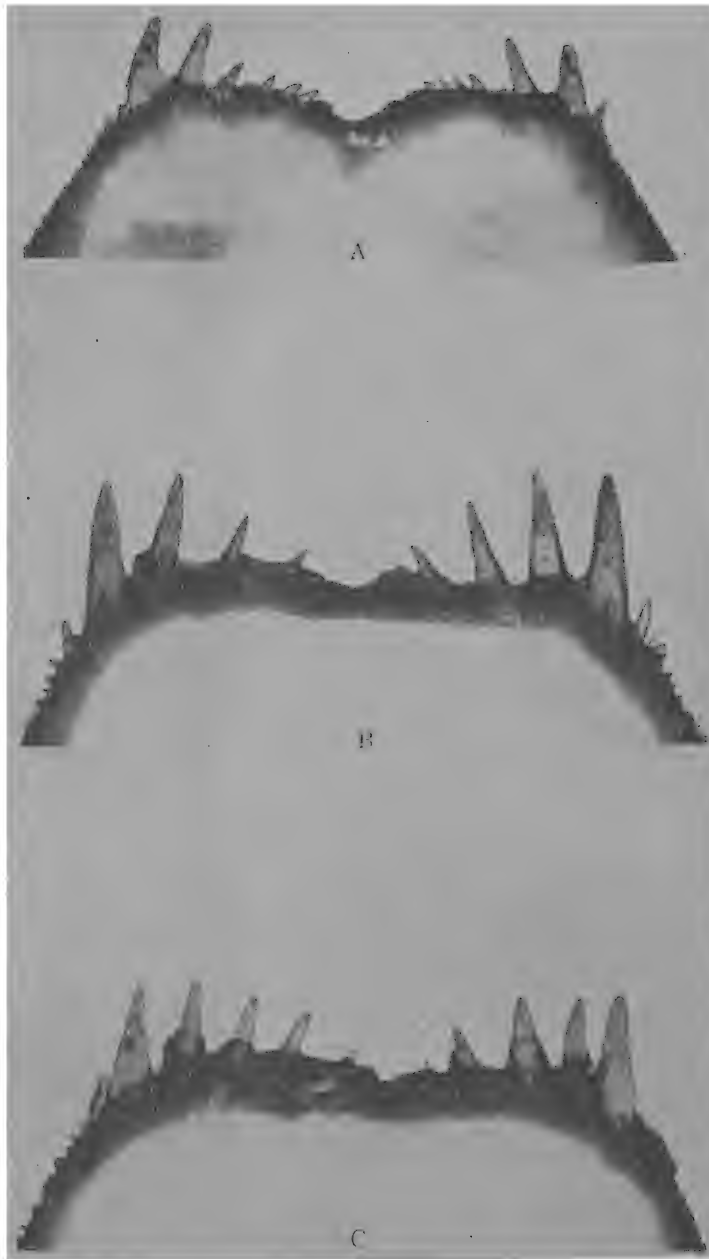
ALBANY MUSEUM,
GRAHAMSTOWN,
June 1934.



A. *Lepidotrigla faurei* G. and T. B. *Lepidotrigla natalensis* G. and T.
The line below each figure represents 1 cm.



A. *Lepidotrigla multispinosa* n. sp. (Type.) B. Dorsal view of head. C. Preorbital spines.
The line below each figure represents 1 cm.



Preorbital spines, $\times 5$, of *Lepidotrigla* species:

A. *faurei* G. and T.

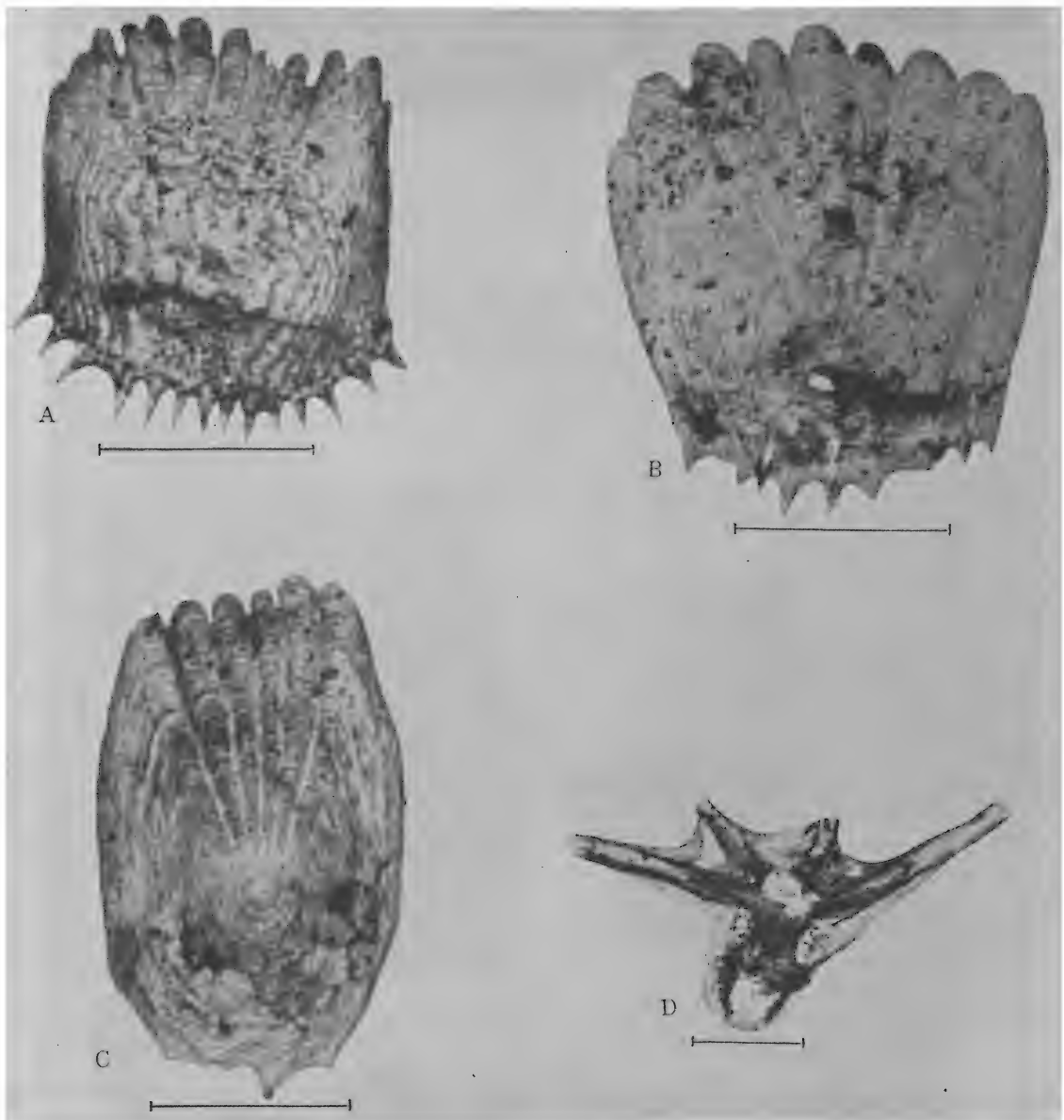
B and C. *natalensis* G. and T., showing limits of variation.



Scales of *Lepidotrigla* species:

- | | |
|---|---|
| A. Above lateral line, below spinous dorsal, of <i>faurei</i> G. and T. | D. Equivalent scale of <i>natalensis</i> G. and T. |
| B. Equivalent scale of <i>natalensis</i> G. and T. | E. From behind pectoral base of <i>natalensis</i> G. and T. |
| C. Ventral, behind breast, of <i>faurei</i> G. and T. | F. 31st lateral line scale of same. |

The line below each scale represents 1 mm.



Scales of *Lepidotrigla multispinosus* n. sp.

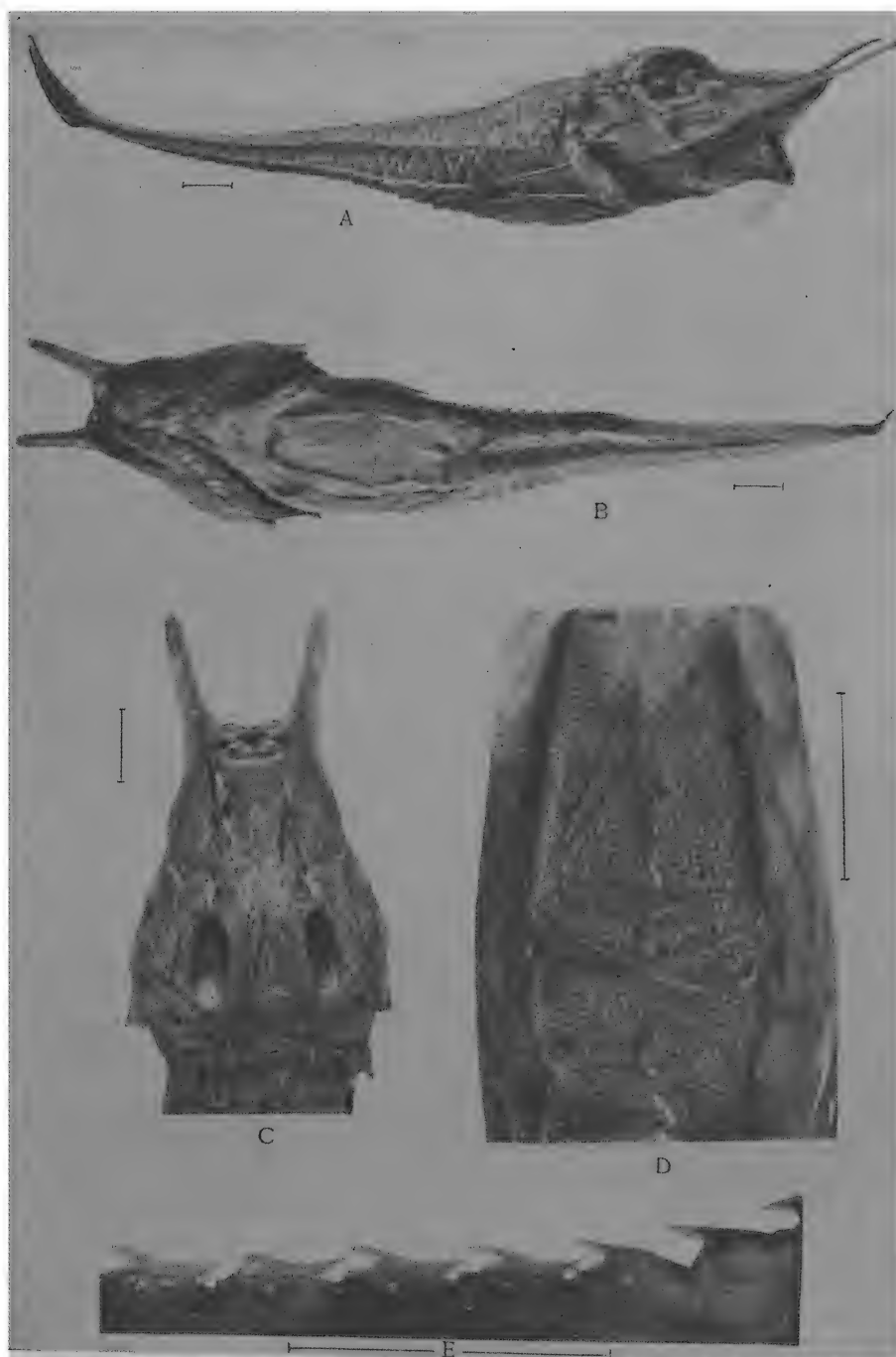
A. Above lateral line, below spinous dorsal.

C. Ventral, behind breast.

B. Behind pectoral base.

D. 30th lateral line scale.

The line below each scale represents 1 mm.



A. *Peristedion weberi* n. sp. (Type.)

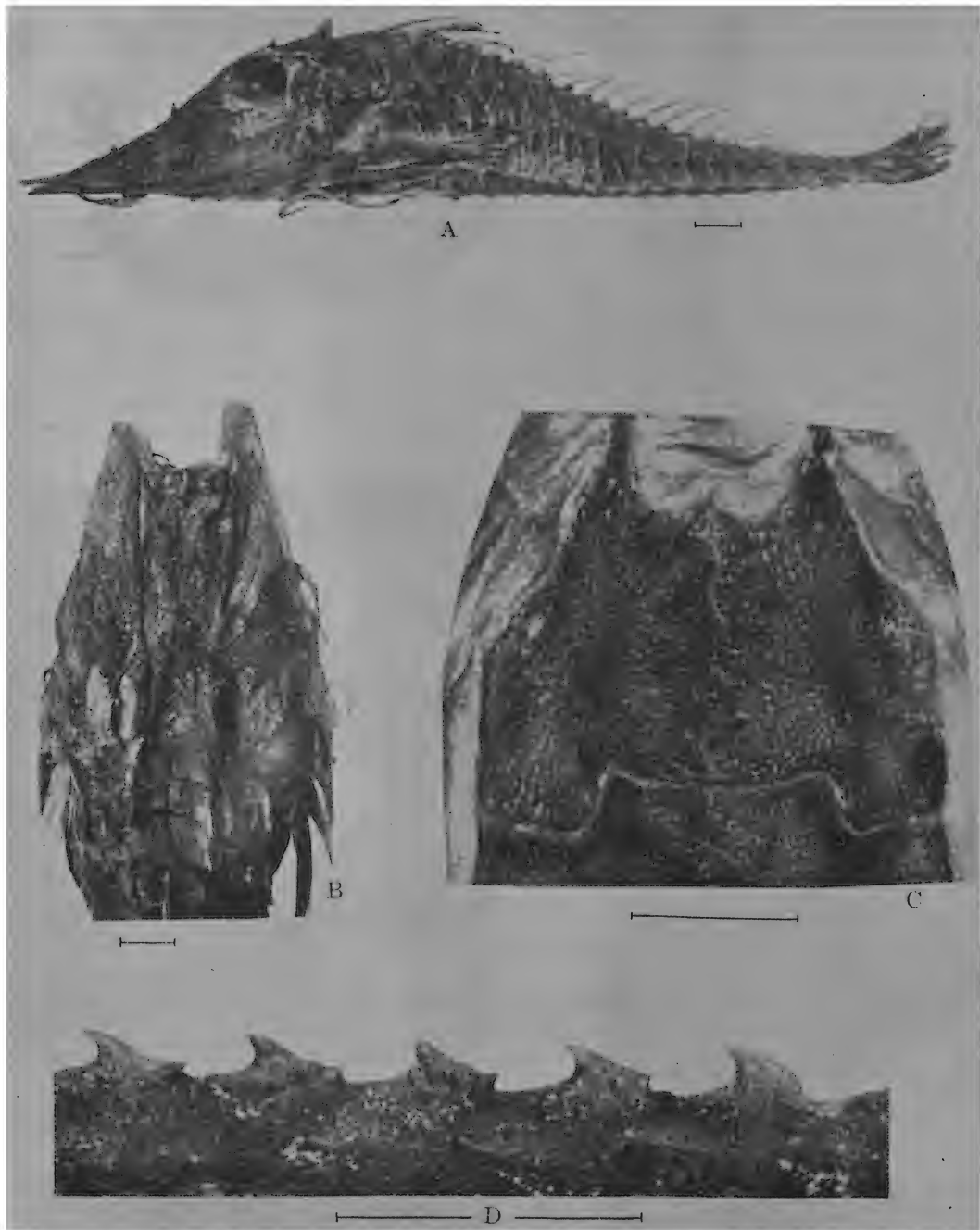
B. Ventral surface.

C. Dorsal view of head.

D. Anterior ventral plates.

E. 21st (right)-27th lateral line spines from above.

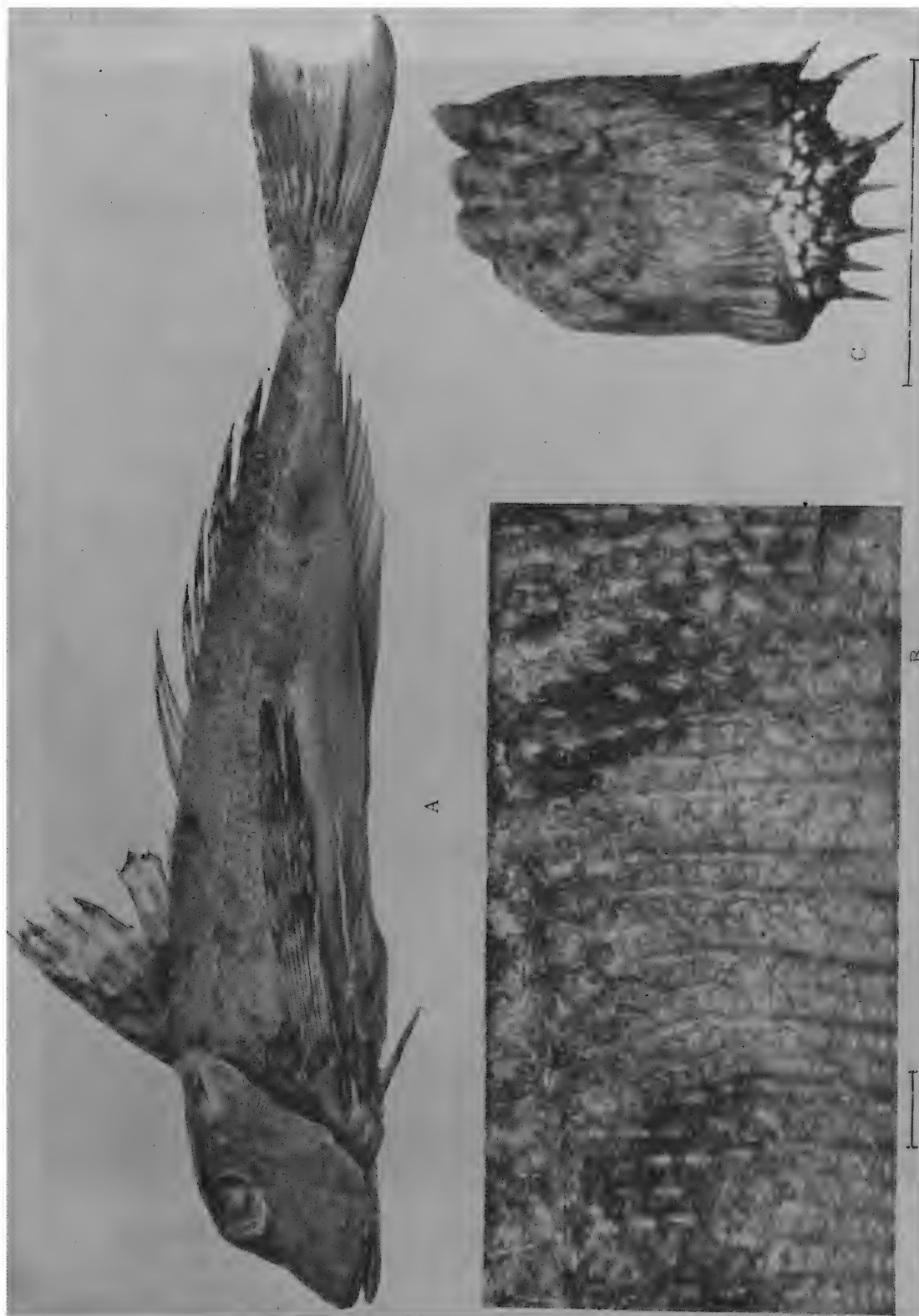
The line with each figure represents 1 cm.



A. *Peristedion adeni* Lloyd.
B. Dorsal view of head.

C. Anterior ventral plates.
D. 20th (right)-24th lateral line spines from above.

The line below each figure represents 1 cm.



A. *Trigla (Trigloporus) africana* n. sp. Nat. size. (Type.)
 B. A portion of the skin below the lateral line, showing a few lateral line scales.
 C. Scale from below the spinous dorsal, above the lateral line.
 The line below B and below C represents 1 mm.

Annals of the South African Museum. Vol. XXX. Part 5.
pp. 587–644. Pls. XV–XXII. February, 1935.

19. *The Fishes of the Family Mugilidae in South Africa*.—By J. L. B. SMITH, M.Sc., Ph.D., Hon. Curator of Fishes, Albany Museum, Grahamstown.

(With Plates XV–XXII and 17 Text-figures.)

[Members of the family *Mugilidae*—known in South Africa as “Harders”—are an important edible commodity. Pappe refers to their value, and an enthusiastic praise of them occurs in the memoirs of Lady Anne Barnard. From the culinary point of view one species of Harder appears to be as good as another, but for scientific purposes it is important to have the species occurring in our waters defined as accurately as possible. In this paper Dr. J. L. B. Smith—a worthy successor of Dr. Andrew Smith in the early part of last century—has tackled a very difficult problem in systematics, which previous writers have left severely alone.—ED.]

Family MUGILIDAE.

The South African species all fall within the single wide genus *Mugil* Linn.

Genus MUGIL Linn.

1861. Günther, Cat. Fish. B.M., vol. iii, p. 409, and p. 466 (*Myxus*).

1884. Jordan and Swain, Proc. U.S. Nat. Mus., vol. vii, p. 261 (*Liza*).

1916. Boulenger, F.W.F. Africa, vol. iv, p. 78.

1920. Athanassoupoulos, Ann. Mus. Civ. Genoa (3), vol. viii, p. 254 ff.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 229, and p. 264 (*Myxus*).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 302, and p. 311 (*Myxus*), and p. 1023.

Body elongate, sub-cylindrical, more or less compressed posteriorly. Head usually somewhat depressed, more or less cuneiform in transverse section, with rounded apex below, generally completely scaly. Scales usually ctenoid, sometimes cycloid, ventral scales more markedly denticulate. Sometimes a secondary cycloid squamation in the investing integument of the scales. No lateral line, but most scales with one or more pits or canals, sometimes more numerous on dorsal scales. Mouth small, terminal or sub-inferior, protractile. Maxilla almost or entirely hidden beneath preorbital, excluded from margin of upper jaw. Upper lip narrow or fleshy, with or without

papillae. Minute recurved teeth, generally compressed and apically dilated, unicuspid, tricuspid, or spatulate, in one or more rows in upper jaw, present or absent. Very minute slender pointed teeth in lower jaw rarely present. Villiform teeth present or absent on vomer, palatines, pterygoids, and tongue. The buccal membrane sometimes with apically dilated cilia. A transverse concavity before the vomer, obscured in some species. Tongue adnate to floor of mouth.

Eyes fairly large, usually with adipose eyelids, rudimentary or highly developed, better developed in adults.

Two dorsal fins; the first, of 4 pungent spines, with a pointed basal scaly process inserted near middle of body, membrane from last ray joined to body. Second dorsal of 1 weak spine and 7-10 rays, inserted above last fourth of body. Anal of 3 weak spines and 8-11 rays, inserted below second dorsal. Pectorals inserted slightly or considerably above middle of side, more or less falcate, with or without an elongate scaly axillary process. Ventrals abdominal, joined by a membrane to the body and to one another. An elongate cuneiform interventral scaly process. Caudal feebly emarginate to forked. Fins, except first dorsal, more or less scaly.

Third and fourth upper pharyngeals fused, enlarged, with convoluted adipose base. Gill-openings wide, membranes separate, free from isthmus. Gill-rakers very numerous, long and close-set; lower pharyngeal rakers functional. Stomach tough and muscular, gizzard-like; pyloric caeca few.

Mugil sensu lato is one of the earliest described genera of fishes, but the natural relationships of the species appear to be but poorly understood, and more or less unsatisfactory division of the wide genus has several times been proposed.

Myxus Gnthr. (*loc. cit.*) was proposed for species with teeth in the jaws, and (sometimes?) on the palate. The validity of this differentiation has been accepted or rejected by systematists without precise definition of the criteria upon which they base their opinions. It is even not unusual to find an author stating that specimens of *Mugil sensu stricto* (*i.e.* accepting *Myxus*) have teeth in the jaws. Further, systematists frequently imply that teeth are absent from the palatal bones of certain species, whereas even a casual examination of their specimens would reveal that teeth are present.

The inaccuracy of many statements about the dentition is probably in part due to the relatively small mouth of *Mugil* species, which renders the examination of the palatal bones, especially in small

and preserved specimens, a troublesome matter. In illustration may be quoted the fact that I have found no mention of lingual teeth, which are by no means infrequently present.

In the South African species there appear to be all degrees between the entire absence of teeth, and the state where most of the normally dentigerous bones are fully dentate. Many of our species have teeth in the jaws, and on the palatal bones, at least as well developed as those present in, e.g., *Elops* Linn. In this latter genus the mouth is large.

In so far as our species are concerned, division of *Mugil sensu lato* on the nature of the dentition alone would be not only of questionable value, but also exceedingly difficult to define and justify. It is not unlikely that this may well apply to all cases where *Myxus* has been recognised.

Jordan and Swain (*loc. cit.*) have proposed the genus *Liza* for species which do not possess adipose eyelids (genotype: *capito* Cuv.), while to *Mugil sensu stricto* are assigned those with eyelids. It has already been pointed out by Jacot (Sci. Rep. Tohok. Imp. Univ., 1930, vol. v, No. 4, p. 827) that division on this feature is of doubtful value, since there is to be found almost every degree between obsolete and fully developed eyelids. Further, it may be indicated that adipose eyelids are, sometimes at least, better developed in the adult than in the juvenile stadia, and, also that as far as the South African species are concerned, the adults of all possess definite, if not always highly developed, eyelids.

It may be noted that species (such as *cephalus* Linn.) which possess well developed eyelids probably always have an edentate vomer, fairly concave anteriorly, while the transverse concavity anterior to the vomer is not usually obscured (all of the American species of *Mugil* appear to be of this type). These differences are nowhere constant and sharp, nor can they be considered as a basis upon which the genus may be divided.

As far as the South African species are concerned, it would be exceedingly difficult to justify the separation of the three with well developed eyelids from the remainder, and I do not propose to attempt it. (But see note on scaling of *cephalus*, p. 19.)

No representatives of the closely related genera *Agonostomus* Benn. and *Cestraeus* C. and V., appear to have been found in our area. The latter at least appears to be well differentiated from *Mugil*.

The majority of museum collections of *Mugil* species appear to be in a somewhat chaotic state, and few systematists care to undertake positive identifications upon which reliance may be placed.

The early descriptions are hardly ever of real diagnostic value, and the diagnoses of many species cannot be anything but provisional. Added to this, differentiation between the species of this genus has proved to be one of the most difficult problems which face the systematist; many of the features which in other groups provide a basis for differentiation here appear to vary little between the different species. The habits and environment of the different species show little variation. It is found that such cases of obscured differentiation sometimes occur in genera in which there is this uniformity of habit and of habitat (e.g. *Epinephelus* Blch.).

In recent literature there is a general tendency to reduce the number of nominal species of *Mugil*. At the same time, it is remarkable that the differentiation of those closely related is still frequently based chiefly upon features, which can, by the examination of large numbers of specimens, be shown to vary widely within any one, and to overlap between related, species. The present confusion may be attributed partly to the fact that where ordinary features have apparently failed to show differentiation between what have quite obviously been different species, systematists have assigned a purely fictitious value to characters which are inconstant and unreliable. The depth of the body, and of the caudal peduncle, the position of insertion of the pectorals, and too restricted and undefined limits for scale-counts, are, among others, comparatively useless features in this genus. On the other hand, it is singular to find how many most significant characters have been entirely overlooked. The nature of the scales and of the teeth are of importance, but have not received the attention they merit. The changes which take place with increase in size have not been properly considered, and many nominal species may prove to be merely different stadia of others. It is remarkable that the highly characteristic form of the ventral fins has not, in so far as I can determine, been regarded as worthy of special description. This is a feature more of generic than specific significance.

Where significant features have been overlooked, it is not unusual to find that two closely related species may be confused. This is probably a frequent occurrence with *Mugil* species, and is in part due to the fact that the features of doubtful validity upon which differentiation is based often vary widely, and the limits can actually never be clearly defined.

A case in point is that of *auratus* Risso, which has been included in our fauna-list upon the authority of Boulenger (*loc. cit.*, p. 86),

The Fishes of the Family Mugilidae in South Africa. 591

who identified * as this species a specimen in the South African Museum from East London. In this he was followed by Barnard (*loc. cit.*, p. 308). Specimens which agree more or less with the usual diagnosis of *auratus* have been found to be the most abundant form from Knysna eastwards. When numbers of these were examined, it was obvious that two well-differentiated species were present, neither of which is *auratus*, nor can either be identified with any existing species. The one species (*canaliculatus* n. sp.) is easily recognised by the multicanalicate dorsal scales, the other (*tricuspidens* n. sp.) by the relatively large tricuspid teeth, besides many other features in each case.

The South African species have stood in need of critical revision. Of the fourteen (incl. *Myxus*) hitherto admitted to our fauna-list, four, viz. *auratus* Risso, *speigleri* Blkr., *saliens* Risso, and *cunnes ius* C. and V., have now been found not valid, while *strongylocephalus* Rich., *oligolepis* Blkr., *tricuspidens* n. sp., and *canaliculatus* n. sp. have been added, and *euronotus* A. Smith, up to now regarded as a synonym of *saliens*, has been revived. *M. diadema* G. and T. has been found to be identical with *compressus* Gnthr., and *ceylonensis* Gnthr. with *buchanani* Blkr. *Myxus barnardi* G. and T. has been found to be a synonym of *Mugil cephalus* Linn.

It may be as well to state that of definite purpose there have been omitted from most of the descriptions those details which, by the examination of a number of specimens, have been found to vary widely, and which can have but little significance. Among these may be mentioned the nature of the dorsal and ventral profiles, of the interorbital, and the degree of compression of the body. Variation in these may result from different methods of preservation, as well as in part from varying degrees of sexual maturity.

It should be emphasised that a critical revision of *Mugil* species, based upon an adequate world collection, is long overdue. Such a revision would be of the greatest value to systematists, if only because *Mugil* is almost cosmopolitan in distribution, and local specimens are contained in probably every Museum collection throughout the world.

It is frankly admitted that the identification of many of our species with those from other parts is provisional only. Not only are the majority of descriptions in the somewhat scanty literature available to me of little diagnostic value, but it has not been possible to secure

* It may be remarked that there is no record of this identification in the S.A. Museum. Boulenger identified other species from specimens in this Museum, of which records have been kept.

the desired number of identified specimens from other parts for examination and comparison. The final pronouncement of the identity of our species must be left to some worker who has at his disposal adequate world material.

The chief aim of the present work has been to establish clearly the differentiation of the South African species.

It will be noticed that there are very few positive statements about synonymy, where such would be based upon descriptions only. I have nevertheless made an exhaustive study of descriptions of our, and of related, species, but in most cases the lack of significant detail would render opinions based upon these of little value.

The localities given in the present work are those from which the specimens were actually obtained. The sizes given are those of the specimens examined.

Certain characteristic features of *Mugil* species which have received little or no attention from systematists, but which appear to be of considerable taxonomic significance, are described below.

GROWTH CHANGES.

There is the usual variation with age in the relative size of the eye, and of the dimensional relationships of the parts of the head. The shape of the dorsal and of the anal fin undergoes considerable modification with growth in some species, e.g. *buchanani* (q.v.). The anterior dorsal and anal rays, the caudal lobes, the pectorals, the pectoral axillary scale, and the adipose eyelids, all appear to increase somewhat in relative size with growth. The exposed surface on the chin increases in size in some species, e.g. *buchanani*, and the scaling on the vertical fins appears to become denser. The origin of the first dorsal frequently appears to move towards the snout, as if there is a somewhat greater increase of the posterior than of the anterior half of the body with growth.

SCALES.

The scales may be cycloid or ctenoid, and in some cases (e.g. *euronotus*) both are present. The denticulations are generally larger, and greater in extent, on scales from the ventral area. The ventral scales are always more elongate than those from the dorsal area.

The form of equivalent scales has been found to be sometimes highly characteristic, and in several cases immediately diagnostic. The multicanalicate scales of *canaliculatus* enable this species to

The Fishes of the Family Mugilidae in South Africa. 593

be distinguished at a glance from all others from South Africa. The dorsal scales of *capito* are, from the early mid-juvenile stadia, denticulate, whereas those of the closely related species *euronotus* are cycloid. Further, the mucus canals of the former species are long and narrow, whereas those of the latter are short and wide.

The young of those species I have examined have cycloid scales, the denticulations appearing as a small mid-posterior patch, which rapidly extends over the whole area (Pl. XIX, A-E, for *capito*).

Two species, *cephalus* Linn. and *strongylocephalus* Rich., are remarkable in possessing two distinct squamations. The main scales are large. In the investing mesodermal integument is found a secondary squamation of minute cycloid scales, which are visible upon the surface of the primary scales (Pl. XV, A and B). This is especially well developed over the occipital area, while, in *cephalus*, the largest of these scales of secondary origin are to be found in the thickened dermal investment of the axillary scales of the pectoral and ventral fins.

Enlarged photographs of the scales of most of the South African species are reproduced in Plates XVII-XX, XXII.

SCALY BASAL PROCESS OF FIRST DORSAL.

One feature of significance is the relative length of the pointed scaly process at the base of the first dorsal fin. Not only does the relative length of this appear to be remarkably constant at all stages in any one species, but it differs between the species, so as to afford in some cases a reliable guide to differentiation. Its use was apparently first proposed by Ninni * (Considerazioni sul genere *Mugil*, Venezia, 1909), but I have not seen this paper, and do not know how he proposed to use it. Later authors have apparently not considered this feature of any value.

DENTITION.

The teeth are always very small, and are in some species very minute, so as to resemble partly or wholly ossified dermal cilia, but they are always, in the upper jaw at least, definitely sub-labial, with the bases adnate to the premaxilla. These premaxillary teeth vary both in size and shape, and have been found to be frequently characteristic, and in some species immediately diagnostic: the tricuspid teeth of *tricuspidens* are larger than those of most others, and enable this species to be easily distinguished.

* *Vide* Athanassopoulos, Ann. Mus. Civ. Gen., 1920, xlviii, p. 255.

The teeth appear to be equally developed at all stages. In older individuals they may be partly hidden by the development of infra-labial spongy tissue, which has probably given rise to the idea that teeth are sometimes better developed in the young, since they are then frequently exsert and more easily visible.

In order to determine the nature of the premaxillary teeth, when they are partly or completely hidden, the following procedure has been found satisfactory. With a sharp pair of fine scissors a thin strip of the upper jaw is snipped off, and soaked for some minutes in rectified spirit. The strip is then placed on a slide and allowed to dry thoroughly. This causes retraction of the enveloping tissue, and leaves the teeth clearly visible.

The teeth possess elongated, dilated, bases.

The teeth of certain species have brown apices. This applies especially to those such as *euronotus* and *tricuspidens*, in which they are apically dilated, like those of the fresh-water *Cichlidae*. It is interesting to note that these species are almost wholly fluvial.

Enlarged photographs of characteristic forms of premaxillary teeth are reproduced in Plate XVII, C-G.

Palatal and lingual teeth are usually villiform or obtusely conical. In old specimens they may be obscured by a layer of mucus, but may be detected by means of a dissecting needle. Those on the tongue are usually present in adjoining patches round the anterior margin, and occasionally also over the slight median ridge of this organ (fig. 8, A).

VENTRAL FINS.

As has been noted previously, the form of the ventrals is highly characteristic, and may prove of use as a generic feature.

The last ray of each fin is connected for a part of its length to the body by a membrane, which is also joined to that from the opposing fin (fig. 1, A and B). This forms a hollow pouch, sub-triangular in cross-section. Over this pouch, and of the same length, or shorter, projects a cuneiform inter-ventral scaly process, consisting usually of five or six series of scales, the apical scale being elongate and pointed (fig. 1, sp.).

The precise function of this peculiar structure is not clear. It is possible that the increased rigidity imparted to the distended ventrals may play some important part in the leaping powers of these fishes. When the fish moves rapidly, the pressure of the water upon the inclined plane of the obliquely extended ventrals would tend

The Fishes of the Family Mugilidae in South Africa. 595

to divert the anterior part of the body upwards. The larger the ventrals, and the more anterior their insertion, the greater will be this effect.

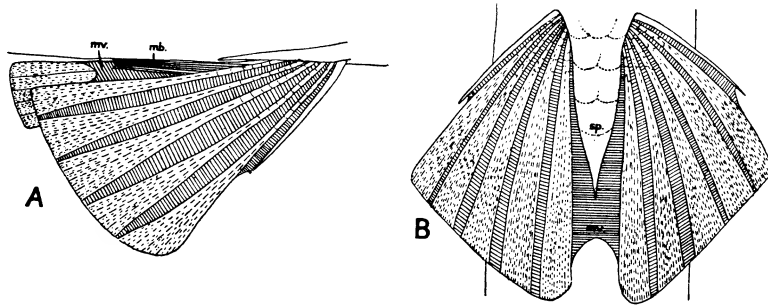


FIG. 1.—Diagram to show the structure of the ventral fins of *Mugil* species—A, lateral view; B, ventral view. mv, membrane connecting ventrals*; mb, membrane joined to body; sp, interventral scaly process.

GILLS AND GILL-RAKERS.

The gill-rakers to the three inner arches are set at right angles to the vertical plane of the gill-arches. The rakers themselves are extremely close-set and form a plane surface, the rigidity of each plane being assisted by the enmeshing of setiform processes which are present on the adjacent basal portions of each raker. The rakers do not interdigitate with those from the adjacent arch, but those of each side of each arch form a gently curved edge, which coincides exactly with that from the adjacent arch (Pl. XV, C).

The lower pharyngeal area is divided by a raised medio-longitudinal ridge, of which a longitudinally grooved anterior dilation is immediately posterior to the basibranchial cartilage. Each half of the lower pharyngeal area is concave, the enlarged upper pharyngeals fitting exactly into the two concavities. The lower pharyngeal bones are themselves very thin, long, curved, and fairly narrow: along the middle of the upper surface of each is a cartilaginous ridge, which bears on each side of the apex, as a continuous curved plane, lamellae exactly similar in structure to, but longer than, the rakers on the functional gill-arches. The edge of the exterior series meets that of the inner series of rakers from the inner functional gill-arch. The inner edge of the inner series of these lamellae is adnate to the cutaneous margin of the medio-longitudinal pharyngeal ridge, while

* Slightly exaggerated.

the lower margins of both series of lamellae are adnate to the upper margin of the pharyngeals, the outer series projecting some distance into the branchial cavity (Pl. XV, C).

It may be presumed that these pharyngeal lamellae have been developed from the true rakers originally present on the arch now modified to form the pharyngeals. If so, it is an interesting example of a surviving integral portion of a highly modified structure, having retained the original form and function despite the profound structural and functional modification of the main structure.

DIMENSIONAL RELATIONSHIPS, ETC.

In order that dimensional relationships and scale-counts shall have their full value, it is essential that the precise limits should be defined. In the present paper the following have been employed:—

Length of Head.—This is measured with dividers in a straight line from the tip of the retracted snout to the hindmost point of the opercular margin on the level of the upper margin of the pectoral base, i.e. it is measured diagonally, and not in profile.

Head without snout is measured from the hind margin of the head to the anterior margin of the orbit.

Length of Pectoral.—This is employed as an important diagnostic character, and is measured from the body to the tip of the pectoral, when the latter is held at right angles to the side.

Caudal Base.—This is taken as the base of the mid-caudal rays, which is obscured by the scaling. The body scales diminish very little in size up to this point, the scales on the basal portion of the rays being generally abruptly smaller. In fresh specimens the bases of the rays are easily visible if the caudal be distended and viewed against a light. In preserved specimens this point is less easily ascertainable, but may generally be determined by similar means. The diagnostic scale-counts employed in the present work may quite easily be made with sufficient accuracy.

Scales : Lateral Series.—This is taken as the number of scales in the first continuous series above the axil of the pectoral, from directly above the hind margin of the head (see *Length of Head*, above) to the caudal base (*q.v.*). The first series above the axil is not usually continuous, being interrupted at the 3rd or 4th scale, whereas the next series above is usually regular, often starting from above the hind margin of the head in a gentle downward curve.

Scales : Transverse Series.—This count can have but little signifi-

cance, since the number of transverse series varies very little between the species. The counts given in this work are taken from before the origin of the first dorsal to the mid-line of the belly.

Scales: Predorsal.—All previous counts of the predorsal scales have been taken from the origin of the first dorsal to the snout. Since the dorsal cephalic squamation is rarely ever regular, counts between these limits are of little value in the absence of precise definition of the method of counting.

The number of predorsal scales does not appear to be of any special significance, as apart from the number in lateral series, but the number of series between the origin of the first dorsal and the point above the hind margin of the head has in each case been recorded.

Angle of Lower Jaw.—This does not alone appear to be of any special significance, but as most workers make some statement about the nature of this feature, it appears advisable to follow suit. The majority of statements appear to have been based upon casual

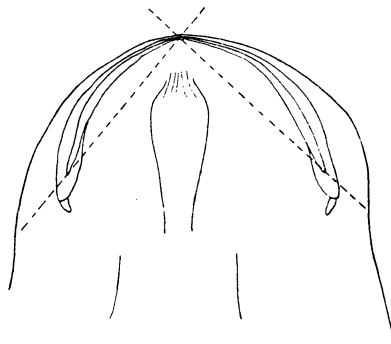


FIG. 2.—Diagram of chin of a specimen of *Mugil*. To show how the angle of the mouth is taken.

estimations, which can have but little value, and actual diagrams in illustration of the angle of the mouth do not infrequently fail to agree with corresponding statements. I have therefore judged it wise to record the actual angle subtended by the corners of the mouth at the symphysis, which is not affected by the nature of the outline of the jaw, this being sometimes rounded, and sometimes angular. This angle has been measured by means of a simple goniometer devised and constructed for this purpose.

Origin of first Dorsal (1) to Snout, (2) to Caudal Base, (3) to Hind Margin of Caudal Rays.—These are measured with dividers, one point at the anterior point of the base of the first dorsal spine, and the other (1) at the tip of the snout, (2) at the mid-point (lateral) of the caudal base, and (3) at the actual hind margin of the mid-caudal rays, respectively.

Length of Pointed Basal Scaly Process of First Dorsal.—This is measured from the anterior point of the base of the first dorsal spine

to the hindmost point (apex) of the scaly process. When the two processes are unequal in length, the longer is measured.

Length of snout is measured obliquely from the tip of the snout to the anterior margin of the orbit.

Total length is measured from the tip of the snout to the hind margin of the mid-caudal rays.

Other measurements are taken in the usual manner.

The interventral scaly process varies very little in relative length between the species, averaging three in head.

Key to the South African species.

- I. Adipose eyelids well developed, the posterior covering more than half of the posterior width of the iris, in some cases reaching to hind margin of pupil.
 - A. Scales 37-42. Pectorals not longer than head without snout.*
 1. Anal rays 7-8. 2nd dorsal not scaly. Anterior eyelid well developed *cephalus.*
 2. Anal rays 9. 2nd dorsal scaly. Anterior eyelid feeble *robustus.*
 - B. Scales 33-35. Pectorals longer than head without snout * *strongylocephalus.*
- II. Adipose eyelids narrow or rudimentary, better visible in adults, round the outer margin of the eye, covering not more than half of the posterior portion of the iris.
 - A. Prominent papillae in several series on lower margin of upper lip, which is very deep at snout tip. (Scales 37-40) *crenilabis.*
 - B. No papillae on upper lip, which is not, or scarcely, more than $\frac{1}{3}$ of eye deep at snout tip.
 1. Scales 41-49.
 - a. Pectorals not longer than head without snout.* Palatine teeth present.
 - x. Scale at base of first dorsal 6.5-8 in distance from origin of first dorsal to snout tip. Soft dorsal completely scaly *euronotus.*
 - y. Scale at base of first dorsal 4-5 in distance from origin of first dorsal to snout tip. Soft dorsal not scaly posteriorly *capito.*
 - b. Pectorals longer (in adults much longer) than head without snout.* No palatine teeth.
 - x. Teeth comparatively large, tricuspid. Pectorals 1.2-1.3 in head. Maxilla well exposed *tricuspidens.*

The Fishes of the Family Mugilidae in South Africa. 599

- y. Teeth not tricuspid, small. Pectorals 1.0-1.1 in head. Maxilla completely concealed *seheli*.
2. Scales 29-40.
- a. End of maxilla concealed. A scaly process in axil of pectoral, longer than $\frac{1}{3}$ length of fin.
- x. Pectorals longer (in adults much longer) than head without snout.* (1.0-1.1 in head.)
- a. Scales 38-40 (42). Longest dorsal ray shorter than ventrals *seheli*.
- β . Scales 33-35. Longest dorsal ray longer than ventrals *buchanani*.
- y. Pectorals not longer than head without snout.* (1.4-1.5 in head, scales 37-39) *robustus*.
- b. End of maxilla exposed. No process, or a very short and blunt one, in axil of pectoral.
- x. Ventrals longer than head without snout.* Scale at base of first dorsal shorter than $\frac{2}{3}$ of postorbital part of head. (Scales 29-32) *compressus*.
- y. Ventrals shorter than head without snout.* Scale at base of first dorsal longer than $\frac{2}{3}$ of postorbital part of head.
- a. Scales 33-35. Pectorals very little longer than head without snout.* Predorsal scales not multicanalicate *macrolepis*.
- β . Scales 36-39. Pectorals longer than head without snout,* usually as long as entire head. Predorsal scales multicanalicate *canaliculatus*.
3. Scales 26-28.
- a. Anal rays 8. Caudal almost truncate. Pectorals partly or wholly black *waigiensis*.
- b. Anal rays 9. Caudal emarginate. Pectorals light *oligolepis*.

Note on Key.—It will be observed that two species (*seheli* and *robustus*) each occur twice in the Key. It appears to be difficult to avoid the use of scale-count as a primary diagnostic character, and *seheli* forms an unfortunate bridge between

* *i.e.* distance from hind margin of head to anterior margin of orbit. The hind margin of the head is always taken on the level of the upper margin of the base of the pectoral.

the two main groups. The method here employed obviates this difficulty. In the case of *robustus* the eyelids shrink on preservation, and might not be accounted large enough for the species to fall in Group I (see note under *robustus*).

Another Key, embracing five Indo-Pacific species likely to be found here, will be found at the end of this paper.

Mugil cephalus Linn.

(Plate XV.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 418 (*constantiae*), and p. 419 (*cephalotus*).

1888. Day, Fish. India, p. 353, pl. lxxv, fig. 3 (*oeur*).

1916. Boulenger, F.W.F. Africa, vol. iv, p. 82, fig. 48 (*oeur*).

1918. Athanassoupoulos, Ann. Mus. Civ. Gen. (3), vol. viii, p. 264.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 253.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 302, and p. 311 (*Myxus barnardi*).

1930. Jacot, Sci. Rep. Imp. Univ. Tohok. (4), vol. iv, No. 4, p. 825 ff.

Snout very broad, bluntly rounded or obtusely angular. Depth 3.5–4, length of head 3.3–4 in length of body. Eye 3.8 (Juv.)–5, snout 3.3–4.8, interorbital width 2–2.4, postorbital length 1.8–2 in length of head. Adipose eyelids well developed, completely encircling pupil, exposed surface of iris small or none (adult), aperture in membrane round or vertically elliptical. Nostrils 2.5 in eye diameter apart, posterior as far from front margin of eye as anterior from profile of snout tip. Lower margin of preorbital not bent or notched, obliquely truncated, maxilla almost or quite concealed, exposed portion increases with age. Angle of lower jaw 65–88°, outline of lower jaw sub-angular, rounded, or undulate. Symphysial knob double. Upper lip thin, width at apex of snout 6 in eye. Curved compressed teeth in one, few, or many series in each jaw. Villiform teeth on pterygoids. Palatines, vomer, and tongue edentate. Prevomerine groove distinct. Exposed area on chin long and wide.

D IV + I, (6–)8. First dorsal inserted 1.0–1.1 times further from caudal base than from tip of snout, 1.3–1.4 times as far from the hind margin of the mid-caudal rays as from the snout tip. First spine 1.6–1.8, base of first dorsal 2.0–2.5 in head. Distance from origin of first to origin of second dorsal 1.0–1.3 (J.) in head. First dorsal inserted above the 13th–14th, second above the 24th–26th lateral scale. Pointed sheath scale extends behind origin of first

The Fishes of the Family Mugilidae in South Africa. 601

dorsal 2·8–3·8 in head, 2·6–3·0 in distance from origin of first to origin of second dorsal, 5·3–6·4 in distance from origin of first dorsal to snout tip. Longest soft ray 1·6–1·8, base of second dorsal 2·0–2·6 in head. Last ray much longer than penultimate, edge of fin concave. Second dorsal scaly basally only.

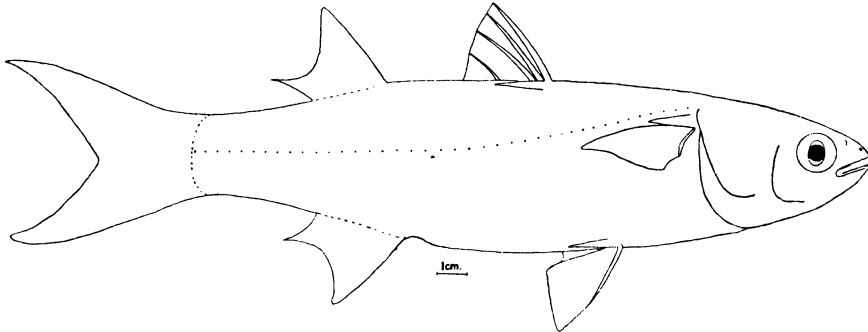


FIG. 3.—*Mugil cephalus* Linn.

NOTE.—In this and other text-figures of species, the lateral row of dots indicates the number and disposition of the lateral rows of scales.

The dimensional relationships involving the length of the head may appear to differ between the text and the figures, but the head in the former is not measured in profile (see p. 596).

A III, 8. Inserted in advance of second dorsal, below the 22nd–25th lateral scale. Longest ray 1·5–1·8 in head, shape of fin similar to that of soft dorsal. Scaly for anterior $\frac{3}{4}$.

P 17, 1·3–1·5 (J.) in head, tip reaches to the 10th–12th lateral scale. Inserted 2·3–3·5 times as far from the ventral as from the dorsal profile. Axillary scale long and pointed, 3·3–4·8 (J.) in head.

Ventrals 1·5–1·6 in head, inserted below in advance of, behind, or at, midway between origin of first dorsal and hind margin of head. Edge of fin truncate. Axillary scale 3·2–4 in head.

Caudal deeply forked, upper lobe longer, increasing with age, mid-rays 1·7–1·9 in head.

Scales ctenoid, predorsal scales 1·0–1·2 times wider than long (Pl. XV, A). Mucus canal long and narrow, often oblique. Most scales, especially those on occipital region, and axillary scales, with a superimposed secondary squamation of minute cycloid scales, developed in the integument, more noticeable in large specimens *

* I have examined specimens from Japan and America, and this secondary scaling is well developed, indicating that it is characteristic of the species and not confined to South African specimens.

(Pl. XV, A and B). Lat. ser. 39–42, l.tr. 14–15, 2 cheek scales, 13–14 predorsal to above hind margin of head.

Colour.—Silvery, darker above. Sometimes longitudinal stripes. Fishes from brackish water generally darker in colour.

Localities.—Lakeside (Cape Peninsula), Knysna River, Kabeljaauws River, Port Elizabeth (Zwartkops River), Kowie River, Great Fish River, Buffalo River, Mazeppa Bay, Durban, Sinkwazi, Kosi Bay. Also Japan, Peru, Chesapeake Bay (N. America).

Length.—Up to 630 mm.

Thirty-four specimens, from 55 mm. up, examined.

The synonymy of this species is rather complex. *oeur* Forsk. is regarded by most authors as conspecific with *cephalus*, but Boulenger (*loc. cit.*) regards the former as distinct in that the angle of the lower jaw is acute, whereas that of *cephalus* is stated to be obtuse. I have seen a juvenile specimen in the S.A. Museum which Boulenger identified as *cephalus*. This specimen has the mouth open, and it appears as if the mandibles are set at an obtuse angle, whereas when the mouth is closed the angle is 84° . I have seen no specimens in which the angle of the mouth is obtuse. It is curious that Günther (*loc. cit.*) gave no diagram of the mouth of *cephalus*, or of related species stated to have a mouth of obtuse angle, whereas he gave numerous diagrams of mouths of acute angle.

I have examined several specimens of *cephalus* from America (kindly donated by Dr. George S. Myers of the U.S. National Museum), and these are in all respects identical with ours. The angle of the mouth falls within the limits of variation in our specimens.

M. cephalus (as here defined) is quite obviously a somewhat polymorphous species. In so far as I have observed, it is almost always fluviatile, and does not commonly occur in the sea. It is possible that purely local forms may show minor variations from the general. The teeth in the jaws, the extent of the exposure of the maxilla, and the shape of the mouth are all extremely variable. In some specimens there is a single series of teeth, while others from the same locality have several or many rows in both jaws. The angle of the mouth varies from 65° – 88° , while the lower jaw may be sub-angular, rounded, or anteriorly undulate. Further, the angle of the mouth does not, in my specimens, become more obtuse with age. Some of the largest have the angle 65° – 70° .

I have endeavoured to find some constant basis among these variations for the establishment of sub-species, but there appears to be no combination of these, or of these with other characters, which

The Fishes of the Family Mugilidae in South Africa. 603

would justify this step. With more intensive study it may be possible to discover combinations of features which will establish definite subspecies. It is not unlikely that a very detailed study of specimens from all parts of the world would probably yield interesting results.

The extraordinary secondary cycloid squamation briefly described above alone merits special attention, and may ultimately prove of importance in the division of the genus, especially as it is present in *strongylocephalus*, which also possesses well-developed eyelids. These smaller scales are quite obviously ossified, and mesodermal in origin.

Myxus barnardi G. and T. is undoubtedly merely a juvenile *cephalus*. Barnard (*loc. cit.*) suspected this, but, possibly because the specimen is damaged, missed the scaly process which is present in the axil of the one undamaged pectoral. This process is always much smaller in the very young stadia.

M. cephalus attains a large size. In brackish vleis, and in the quiet upper reaches of lagoons and estuaries, specimens up to ten pounds in weight are not infrequently encountered. This species possesses very considerable leaping powers, which are not, however, as great as those of *tricuspidens*, while the type of leap is also different: *cephalus* leaps with the head well up, and the body curved, whereas the former species jumps much further, with the body more or less straight and parallel with the surface of the water.

Mugil robustus Gnthr.

(Plates XXI, A, and XXII, A, B.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 432.

1916. Boulenger, F.W.F. Africa, vol. iv, p. 92, fig. 54.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 305.

Body markedly robust anteriorly, tapering posteriorly. Snout fairly broad, bluntly rounded, upper lip forms oblique truncated margin. Depth 4.0, length of head 3.9 in length of body. Eye 4.1-4.3, snout 3.7, interorbital width 2.5, postorbital part of head 1.8 in length of head. Adipose eyelids very fragile, but well developed, especially the posterior, which extends almost to the hind margin of the pupil; the anterior covers about half of the width of the iris. (With preservation the eyelids appear to shrink considerably.) Nostrils 2.8 in eye diameter apart, the anterior as far from snout tip profile as the posterior from the front margin of the eye. Lower margin of preorbital not notched, sharply bent downwards over the angle of the mouth, end scarcely serrate, slightly convex. Maxilla

completely concealed. Angle of lower jaw $110-112^{\circ}$; outline of jaw angular. Symphysial knob single. Upper lip fairly thin, width at apex of snout 4 in eye. No teeth in any part of mouth. Prevomerine groove well marked. Exposed area on chin long and very narrow.

D IV + I, 8. First dorsal inserted 1.05–1.08 times further from caudal base than snout tip, 1.4 times as far from the hind margin of the mid-caudal rays as from snout tip. First spine 1.7, base of first dorsal 1.9–2 in head. Distance from origin of first to origin of second dorsal 1.0–1.1 in head. First dorsal inserted above the 12th, second above the 23rd–24th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.3–2.4 in head, 2.2 in distance from origin of first to origin of second dorsal, 1.3 in postorbital part of

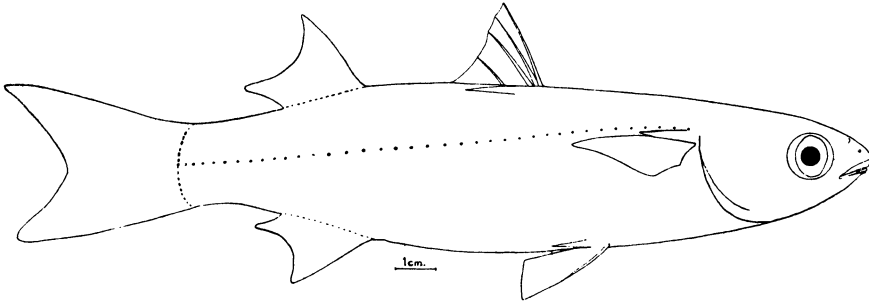


FIG. 4.—*Mugil robustus* Gnthr. (see note, fig. 3).

head, and 4.3–4.4 in distance between origin of first dorsal and snout tip. Longest soft ray 2.0, base of second dorsal 2.3–2.5 in head. Last ray slightly longer than penultimate. Fin scarcely falcate, edge concave; completely scaly.

A III, 9. Inserted in advance of second dorsal, below the 22nd–23rd lateral scale. Longest ray 2.1 in head; shape of fin similar to that of soft dorsal; completely scaly.

P 15, 1.4–1.5 in head, shorter than head without snout, tip reaches to the 10th lateral scale. Inserted 2.4 times as far from the ventral as from the dorsal profile. Axillary scale large and pointed, 3.5 in head, 2.5 in pectoral.

Ventrals 1.6 in head, inserted below midway between origin of first dorsal and hind margin of head. Edge of fin subtruncate. Axillary scale 3.0 in head.

Caudal moderately forked, upper lobe longer, mid-rays 1.8 in head.

Scales cycloid or very feebly denticulate, or with scalloped edge, predorsal scales slightly longer than wide (Pl. XXI, A and B). No

The Fishes of the Family Mugilidae in South Africa. 605

secondary squamation. Lat. ser. 37–39, l.tr. 12–13, three cheek scales, 12 predorsal to above hind margin of head.

Colour.—Bright silvery, slightly dusky above. Sometimes a golden opercular spot. Traces of faint longitudinal stripes. Axillary spot very distinct.

Localities.—Isipingo lagoon, Durban Bay, Kosi Bay.

Length.—Up to 230 mm.

Four specimens, from 190 mm. up, examined.

This appears to be a well-defined, but comparatively scarce and localised species.

Previous descriptions do not agree very well. Günther (*loc. cit.*) specifically mentions the well-developed adipose eyelids, whereas Boulenger (*loc. cit.*) neither describes them nor shows them in his figure. Barnard (*loc. cit.*) possibly never saw a specimen, and may have been misled by Boulenger's work.

As has been indicated above, the adipose eyelids of *robustus* are abnormally thin, and tend to shrink with preservation, especially if the specimen is permitted to become even superficially dry. Even so, the eyelids are then so well marked as to merit special mention.

It would be strange to find any species as strictly localised as this would appear from its recorded area. Day (Fish. India, 1888, p. 356) described as *caeruleomaculatus* Lacep., a species, which, except for the absence of adipose eyelids, agrees exactly with the diagnosis of *robustus*. I have not seen the original description of *caeruleomaculatus*, but Günther's diagnosis (*loc. cit.*, p. 445) of that species, while rather brief, agrees with that of Weber and de Beaufort (Fish. Indo-Aust. Archip., 1922, vol. iv, p. 250), and fits quite well a specimen of this species (from India) which I have examined and which is quite distinct from *robustus*. It is not unlikely that Day may have examined preserved specimens with eyelids so shrunken as to have misled him. It is extremely likely that Day's specimens were actually conspecific with *robustus*, in which case this species extends from Africa through Mauritius to the Indo-Malayan area, which appears reasonable.

According to the Indian netters on the Natal coast, *robustus* is never very plentiful, but relatively large numbers appear on the coasts in May. Unfortunately, little reliance can be placed upon their identifications.

M. robustus is closely related to *cephalus* as well as to *seheli*. From the former it is distinguished by the extra anal ray, by the nature of the eyelids, by the shape of the mouth, and by the scaly median fins. From the latter by the much shorter pectorals, and by the presence

of eyelids, as well as in dimensional relationships. It could scarcely be confused with any other South African species.

Mugil strongylocephalus Rich.

(Plates XVI, A, and XVIII, A, B.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 425, and p. 428 (*longimanus*).

1888. Day, Fish. India, p. 349, pl. lxxiv, fig. 3 (*cunnesius*).

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 239 (*longimanus*).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 302 (*cunnesius*).

1925. Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxvii, p. 208 (*longimanus*).

Depth 3·8, length of head 3·6 in length of body. Eye 3·7, snout 3·6, interorbital width 2·3–2·5, postorbital 1·8–2·0 in length of head. Adipose eyelids well developed, almost encircling pupil, posterior more prominent, almost reaching pupil, aperture in membrane elliptical. Nostrils $\frac{1}{4}$ of eye diameter apart, anterior midway between profile of snout tip and anterior margin of eye. Lower margin of preorbital slightly bent, scarcely notched. End of preorbital narrow, serrated, maxilla almost concealed. Angle of lower jaw 92–96°, outline of jaw angular, or very slightly rounded (adults). Symphysial knob double. Upper lip thin, width at apex of snout $\frac{1}{6}$ of eye. Very minute pointed teeth in a single row in upper jaw. Villiform teeth on pterygoids and possibly also on tongue. Traces of minute teeth on vomer. Palatines and lower jaw edentate; exposed area between rami of mandibles short and narrow.

D IV + I, 8. First dorsal inserted 1·0–1·06 times as far from the tip of the snout as from caudal base, 1·2–1·3 times as far from the tip of the mid-caudal rays as from tip of snout. First spine 1·8–2·1, base of first dorsal 1·9–2·2 in head. Distance from origin of first to origin of second dorsal 1·15–1·25 in head. First dorsal inserted above the 10th–12th, second above the 19th–20th lateral scale. Pointed sheath scale extends behind first dorsal 2·2–2·5 in head, 1·8–2·2 in distance from origin of first to origin of second dorsal, 4·0–4·6 in distance from origin of first dorsal to tip of snout. Second soft ray 1·6–1·8, base of second dorsal 2·7–2·9 in head. Last ray longer than penultimate, fin not much elevated anteriorly, edge concave. Soft dorsal at least partly scaly.

A III, 9, inserted in advance of second dorsal, below the 17th–18th

The Fishes of the Family Mugilidae in South Africa. 607

lateral scale. Second ray 1.6–1.8 in head; shape of fin similar to that of dorsal; scaly.

P 15–16, 1.06–1.25 in head, tip reaches to 11th–12th lateral scale, inserted 2.6–3 times as far from the ventral as from the dorsal profile. Axillary scale, bluntly rounded or pointed, 3–3.5 in head.

Ventrals 1.6–1.7 in head, inserted below 1.1–1.2 times as far from the origin of the first dorsal as from the hind margin of the head. Edge of fin gently rounded. Axillary scale 2.7–3.0 in head. Ventrals and pectorals scaly on basal half.

Caudal moderately forked, mid-rays 1.8 in head; scaly.

Scales cycloid; mucus canal long and narrow. Predorsal scales

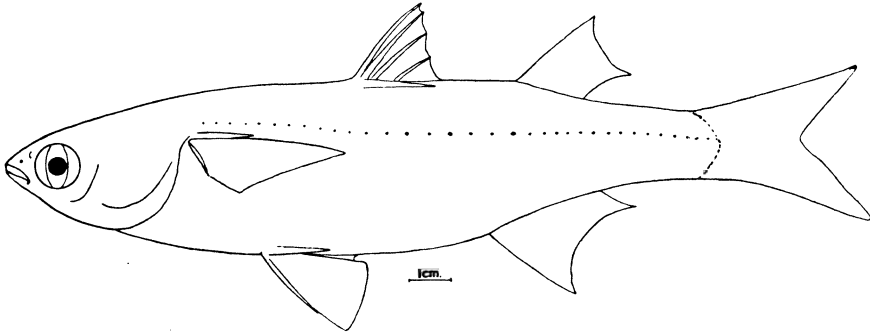


FIG. 5.—*Mugil strongylocephalus* Rich. (see note, fig. 3).

1.1 times as wide as long (Pl. XVIII, A and B). Lat. ser. 33–35, 1.tr. 11–12, 3–4 cheek scales, 11–12 predorsal to above hind margin of head. A few small secondary elongated cycloid scales upon the scales of the nuchal region. (Also found in a specimen from India.)

Colour.—Silvery, slightly darker above. Caudal with dark margin. Pectoral axil black.

Localities.—Isipingo lagoon, Durban, Beira, Bay of Bengal.

Length.—Up to 195 mm.

Seven specimens, from 140 mm. in length up, examined.

I have not seen the original description, and the diagnosis of these specimens as *strongylocephalus*, being based on Günther's description (*loc. cit.*) of the type (and of others?), is provisional only.

There appears to be a somewhat hopeless confusion in regard to specimens described as *engeli* Blkr., *kelaartii* Gnthr., *longimanus* Gnthr., and *strongylocephalus*, the types of all of which come from the Indo-Pacific. I have seen only Günther's description of the latter species. The majority of authors agree in placing *kelaartii* in the synonymy

of *engeli*, but this appears to be doubtful. The former species was described from very young specimens, in which the pectorals are generally shorter than in the adult, and yet the pectorals of these juvenile types are stated to be actually longer than those of adult *engeli*. A critical revision of these two species would almost certainly establish that *kelaartii* is distinct from *engeli*.

M. kelaartii is held to be distinct from *longimanus* (*fide* Günther) mainly because the pectorals of the former are somewhat shorter. Here again the difference in size between the type-specimens would easily account for the slightly shorter pectorals of the former species, and the two are most probably conspecific. Further, the upper lip of *longimanus* is stated by Günther (*loc. cit.*) and by Weber and de Beaufort (*loc. cit.*) to be rather thick, whereas Day's figure (*loc. cit.*) shows a thin lip. The specimens described above have a thin lip, and, with the exception of the point of insertion of the first dorsal, agree exactly with Day's figure.

The head and chin of *strongylocephalus* as figured by Günther agree exactly with those of my specimens, and I can find nothing of importance in which they differ from Günther's description of that species. I have examined a specimen from the Bay of Bengal, kindly lent by the Indian Museum, Calcutta, labelled *cunnesius* C. and V., which agrees in all particulars with my specimens, and with Günther's description and figures of the head of *strongylocephalus*.

M. kelaartii and *longimanus* are held to differ from *strongylocephalus* in that the maxilla of the former two is entirely concealed, whereas the tip of that of the latter remains visible. Günther does not state the size of the type of the latter species, but it is, from what he says, presumably an adult. I have found that the extremity of the maxilla is generally more exposed in large specimens. In my specimens, especially in the smallest, when the mouth is pressed shut, it appears as if the maxilla is entirely hidden, but a careful examination reveals that the extremity always remains visible. This slight difference can alone scarcely justify the maintenance of *kelaartii* and *longimanus* as distinct from *strongylocephalus*, and in my opinion they are most likely conspecific. Fowler's Delagoa Bay specimen appears to be unquestionably conspecific.

This species, which appears to be widely distributed in the Indo-Pacific, will probably be found to be fairly common in Natal waters with more intensive collection.

It is easily distinguished by the well-developed eyelids, the long pectorals, and the scale-counts from all other South African species.

The Fishes of the Family Mugilidae in South Africa. 609

Mugil crenilabis Forsk.

? 1861. Günther, Cat. Fish. B.M., vol. iii, p. 458.

1888. Day, Fish. India, p. 355.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 307.

Depth 3·8–4·3, length of head 3·2–3·4 in length of body. Eye 3·8–4, snout 3·5, interorbital width 2·3–2·5, and postorbital length 1·9 in length of head. Adipose eyelids rudimentary. Nostrils $\frac{1}{4}$ eye diameter apart, anterior midway between front margin of eye and profile of snout tip. Lower margin of preorbital bent, deeply emarginate, end dilated, serrae large. Maxilla completely concealed.

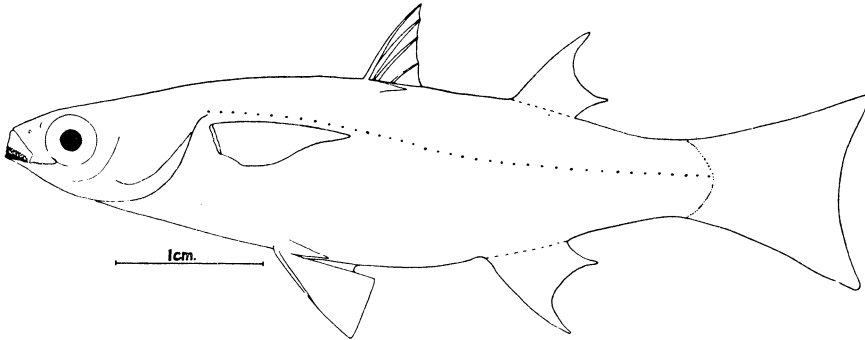


FIG. 6.—*Mugil crenilabis* Forsk. (see note, fig. 3).

Angle of mouth 94–96°, outline of jaw sub-angular. Upper lip thick, half, or slightly less than half, eye diameter at snout tip; lower margin with 5–6 series of fleshy tubercles, the lower with apical branches. Lower lip with expanded rugose plicate fringe. Exposed area on chin small and narrow. No teeth visible in jaws, or on palatal bones. Minute teeth on tongue.

D IV + I, 8. First dorsal inserted 1·0–1·06 times as far from snout tip as from caudal base, 1·3 times as far from the hind margin of the mid-caudal rays as from snout tip. First spine 2·1–2·3, base of first dorsal 4 in head. Distance from origin of first to origin of second dorsal 1·3–1·4 in head. First dorsal inserted above the 12th, second above the 24th lateral scale. Pointed sheath scale very short, extends behind origin of first dorsal 4·6 in head, 3·3 in distance from origin of first to origin of second dorsal, 8 in distance from origin of first dorsal to snout tip. Longest soft ray 1·8, base of second dorsal 3·5 in head. Second dorsal sub-falcate, edge concave; scaly.

A III, 9, inserted in advance of second dorsal, below the 23rd lateral scale. Longest ray 1·8 in head. In shape similar to dorsal.

P 16-17, 1·3-1·4 in head, tip reaches 12th lateral scale, inserted 2·5-3 times as far from the ventral as from the dorsal profile. No axillary scale, or a very indistinct short process.

Ventrals 1·7 in head, inserted below midway between hind margin of head and origin of first dorsal. Edge of fin truncate. Axillary scale 3·5-4 in head.

Caudal emarginate, lower lobe slightly longer, mid-rays 1·7 in head.

Scales cycloid, but with rudimentary scalloping on posterior margin, indicating that adults will probably have ctenoid scales. Predorsal scales about as wide as long. Lat. ser. 37-40, l.tr. 13-14, 3-4 cheek scales, 12-13 predorsally to above hind margin of head.

Colour.—(Preserved.) Uniform light brown.

Locality.—Durban.

Length.—Up to 56 mm.

Two specimens, 54 and 56 mm. in length, examined.

This is the only species from South Africa with tubercular lip, and it is easily distinguished from our others by this feature alone.

It is evidently fairly rare: I have seen none but the two S.A. Museum specimens described above. It has been stated to attain a length of over 200 mm., and to be fairly widely distributed in the Indo-Malayan area. I am not quite certain that our specimens are actually *crenilabis*, but they are very small and not too well preserved, so that I am unable to venture any definite opinion on the matter. The above description is taken as a composite from both specimens.

Probably *ruppellii* Gnthr. (*loc. cit.*, p. 458) is not different.

Mugil euronotus Smith.

(Plates XVI, E; XVII, E; XIX, G, H.)

? 1849. Smith, *Illus. S.A. Pisces*, pl. xxix, fig. 2.

1861. Günther, *Cat. Fish. B.M.*, vol. iii, p. 443 (*saliens* part).

1861. Boulenger, *F.W.F. Africa*, vol. iv, p. 85 (*saliens* part).

1925. Barnard, *Ann. S.A. Mus.*, vol. xxi, p. 307 (*saliens* part).

Depth 3·9-4·6, length of head 3·2 (J.)-4·5 (Ad.) in length of body. Eye 4·0 (J.)-4·8 (Ad.), snout 3·2 (Ad.)-3·7 (J.), interorbital width 2·2-2·6, and postorbital length 1·8-2·0 in length of head. Adipose eyelids rudimentary, better visible in adults. Nostrils $\frac{1}{6}$ of eye diameter apart, anterior nearer profile of snout tip than anterior

The Fishes of the Family Mugilidae in South Africa. 611

margin of eye. Lower margin of preorbital gently curved downwards, not notched, serrate. Maxilla not, or only extreme tip, exposed. Preorbital scaly. Angle of lower jaw $95-98^\circ$. Outline of jaw rounded or angular. Symphyseal knob single. Upper lip fairly thick, width at apex of snout 3-3.5 in eye. Relatively large, close-set, flattened, recurved, dilated spatulate teeth with a notch at each side of apex (strangulated) (Pl. XVI, E) in a single series in upper jaw, similar in all stadia. Small cilia sometimes in lower jaw. Villiform teeth on vomer, palatines, pterygoids, and tongue. Exposed surface on chin long and narrow in juveniles, long and wide in adults.

D IV + I, 8. First dorsal inserted nearer caudal base than tip of snout, 1.04-1.07 times as far from the latter as from the former,

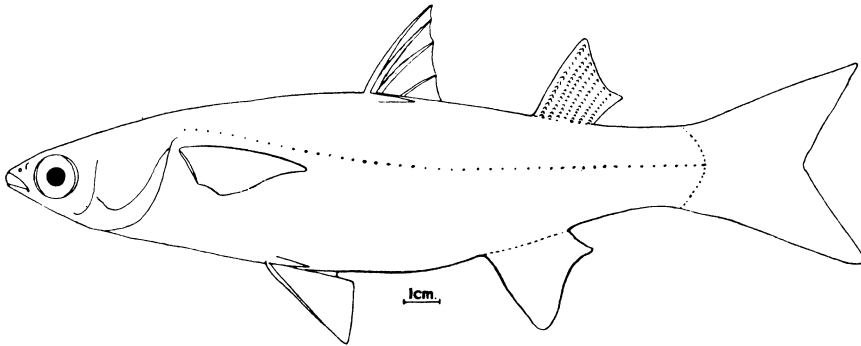


FIG. 7.—*Mugil euronotus* A. Smith (see note, fig. 3).

1.18-1.22 times as far from the hind margin of the mid-caudal rays as from the tip of the snout. First spine 1.7-1.9, base of first dorsal 2.4-2.7 in length of head. Distance from origin of first to origin of second dorsal 1.1-1.3 (Ad.) in head. First dorsal inserted above the 15th-17th, second above the 28th-30th lateral scale. Pointed sheath scale extends behind origin of first dorsal 3.5-4.0 in head, 6.5-8 in distance from tip of snout to origin of first dorsal, 2.9-3.5 in distance from origin of first to origin of second dorsal. Second soft ray 1.9-2.5, base of second dorsal 2.0-2.2 in head. Last ray slightly longer than penultimate, fin little elevated anteriorly, edge gently concave. Second dorsal completely scaly.

A III, 9, inserted in advance of second dorsal, below the 26th-27th lateral scale. Second ray 1.8-2.1 in head, last ray longer than penultimate, edge of fin slightly concave; scaly.

P 17, 1.4-1.5 in head, tip reaches to the 10th-12th lateral scale,

inserted 1·9–2·6 times as far from the ventral as from the dorsal profile. No axillary scale.

Ventrals 1·5–2·2 (J.) in head, inserted below midway between base of pectoral and origin of first dorsal, or nearer the latter. Edge of fin almost truncate. Axillary scale 4·3–5 in head.

Caudal moderately forked, upper lobe longer in adults; mid-rays 1·8–2·0 in head.

Scales predorsally cycloid, becoming ctenoid on sides and belly. Predorsal scales slightly wider than long (Pl. XIX, G and H), l.r. 43–45, l.tr. 14–15. Four cheek scales, 16–17 predorsal to above hind margin of head.

Colour variable. In sea, light dusky above, silvery below. In fresh or brackish water, almost black above, shading through dusky to light below.

Locality.—Knysna River, freshwaters of the Eastern Province, Port Alfred (river), Fish River, Buffalo River, Durban (harbour?), Sinkwazi River.

Length.—Up to 300 mm.

Seventeen specimens, from 55 mm. up, examined.

Plesiotypes, from Knysna, in the Albany Museum.

This has proved a very troublesome species. I was at first inclined to consider our specimens conspecific with *saliens* Risso, which is apparently so closely related to *capito* Cuv. that the majority of workers have found the greatest difficulty in differentiating at all clearly between them (see p. 616). Yet a careful examination of my specimens revealed so many striking differences from the latter species that I felt it was impossible for previous workers to have missed them.

I have sent a specimen to Mr. Norman of the British Museum, who has kindly compared it with their specimens of *saliens*. He has stated that theirs are rather small, but that the specimen I sent him is unquestionably different. He has also compared this with the various badly stuffed types of A. Smith, but is unwilling, in view of the condition of the latter, to give any opinion. I have examined specimens from Italy, among which were reputed *saliens*, but my specimens are unquestionably not conspecific.

In so far as I am able to judge from Smith's figure (*loc. cit.*) *euronotus* was probably identical with the present species. The first dorsal (in the figure) is inserted slightly behind midway between the base of the caudal and the tip of the snout, and the scale at the base of the first dorsal is shown to be about 8 in the distance from the origin of the first dorsal to the tip of the snout. Further, the maxilla is

The Fishes of the Family Mugilidae in South Africa. 613

drawn as if the tip would be hidden, or only just exposed, when the mouth is closed. The typical scaly second dorsal and the relatively large eye are not shown. Smith also mentions the presence of a row of "small criniform teeth in the upper jaw." Besides this, Smith's name possibly has reference to the markedly broad nuchal region,* which is characteristic. I am therefore provisionally reviving *euronotus*. This is preferable to instituting a new species, since *euronotus* is so numerous and widely distributed in our fresh and brackish waters that it is more than likely that A. Smith actually secured a specimen.

M. euronotus is very easily distinguished from all other South African species by many features, chief of which are the very short scaly process at the base of the first dorsal fin and the characteristic premaxillary teeth. These, with the scaly nature of the soft dorsal and the markedly larger eye, serve to distinguish this species immediately from *capito* in all stadia.

On our southern coasts, in my experience, *euronotus* rarely occurs in the sea. I have caught and identified well over a thousand specimens of *Mugil*, from the sea, from estuaries, and from fresh water. Only two specimens of this species have been found in the sea; in each case near the mouth of a tidal river, and in one case after a flood. In tidal estuaries *euronotus* is not usually found near the sea but high up the river, where the salinity of the water is low. Curiously enough, in Natal waters the species appears to be as commonly found in the sea itself.

In the Eastern Province *euronotus* occurs in most of the fresh waters, in most cases in isolated pools which have no connection with the sea. The species appears to thrive in dams, into which it has been introduced. It appears to breed freely in such waters, and many farmers ensure a regular supply of fresh fish by stocking dams or pools on their farms.

Mugil capito Cuv.

(Plates XVII, C; XIX, A-F.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 439.

1916. Boulenger, F.W.F. Africa, vol. iv, p. 83, fig. 49.

1918. Athanassoupoulos, Ann. Mus. Civ. Gen., vol. xlviii, p. 26.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 304.

* *euronotus* (=S. × S.E. wind) may, however, refer indirectly to the part of our area, *i.e.* the south and south-eastern coastal regions, in which this species occurs, although Smith states that it inhabits the *seas* of the eastern and western coasts. Smith may have meant *eurynotus*.

Depth 3·8–4·4, length of head 3·6–4·2 (J.) in length of body. Eye 4·7 (J.)–6·3 (Ad.), snout 3·2–3·6, interorbital width 2·2–2·7, and postorbital length 1·8–1·9 in length of head. Adipose eyelids rudimentary, scarcely visible in juveniles, better developed in adults, but never extending further than the outer rim of the iris. Nostrils $\frac{1}{8}$ of eye diameter apart, anterior midway between anterior border of eye and profile of snout tip. Lower margin of preorbital scarcely bent, sometimes with a very small notch, lower and hinder margins serrate, scaly. End of maxilla well exposed. Angle of lower jaw 93–103°, outline of jaw subangular in juveniles, more rounded in

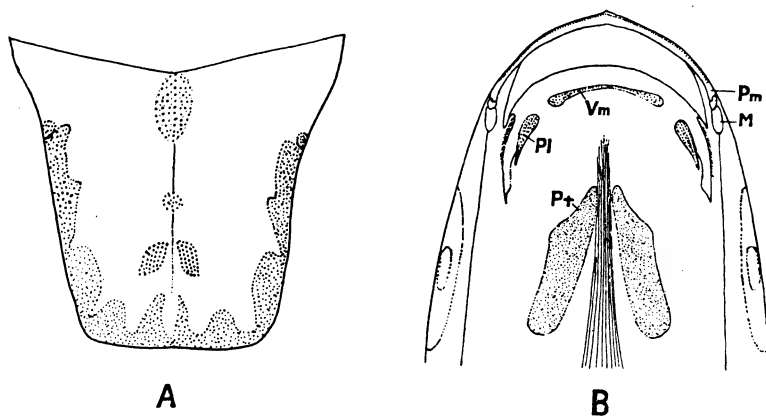


FIG. 8.—Diagram to show the dentition of *Mugil capito*. A, tongue; B, upper jaw and palate. M, maxilla; Pl, palatines; Pm, premaxilla; Pt, pterygoids; Vm, vomer. Dentate areas dotted.

adults. Symphysial knob double. Upper lip fairly thin, width at snout apex 3·5 in eye. Slightly flattened, recurved, subspatulate teeth in a single fairly widely spaced row in the upper jaw (Pl. XVII, C). Lower jaw edentate. Villiform teeth on vomer, palatines, pterygoids, and tongue (fig. 8).

D IV + I, 8–9. First dorsal inserted nearer tip of snout than base of caudal, 1·06–1·1 times as far from the latter as from the former, 1·30–1·38 times as far from the hind margin of the mid-caudal rays as from the tip of the snout. First spine 1·7–2·0, base of first dorsal 2·1–2·5 in head. Distance from origin of first to origin of second dorsal 0·95–1·2 (J.) in head. First dorsal inserted above the 14th–16th, second above the 28th–30th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2·3–2·6 in head, 2·0–2·6 in distance from origin of first to origin of second dorsal, 4–5 in distance from

The Fishes of the Family Mugilidae in South Africa. 615

origin of first dorsal to tip of snout. Longest soft ray 1.9–2.3, base of second dorsal 2.9–3.5 in head. Last ray slightly longer than penultimate, fin slightly elevated anteriorly, edge gently concave. Second dorsal scaly basally and anteriorly only.

A III, 9. Inserted slightly in advance of second dorsal, below the 26th–29th lateral scale. Longest ray 1.8–2.3 in head. In shape fin resembles dorsal. Scaly anteriorly and basally.

P 16–18, 1.45–1.75 in head (usually 1.6–1.7), tip reaches to the 10th–12th lateral scale. Fin scarcely ever as long as postorbital plus eye, inserted 1.5–2.3 times as far from the ventral as from the

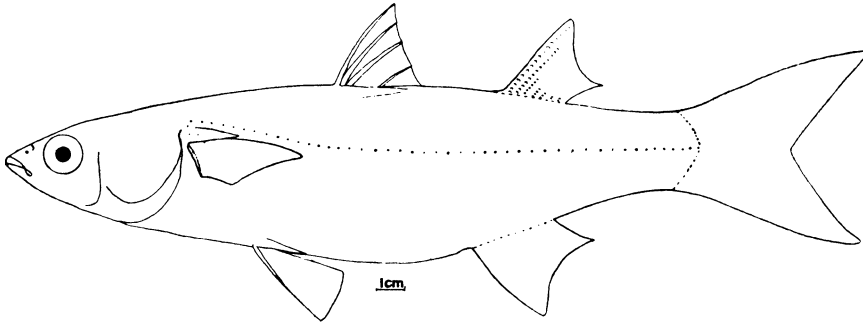


FIG. 9.—*Mugil capito* Cuv. (see note, fig. 3).

dorsal profile. Axillary scale 2.7 (Ad.)–4.5 in length of pectoral, obscure in young specimens.

Ventrals 1.6 (J.)–1.9 in head, inserted below midway between origin of first dorsal and hind margin of head, or slightly behind or before. Axillary scale 3.3–3.6 in head. Edge of fin truncate.

Caudal moderately forked, upper lobe slightly longer, mid-rays 2.1–2.5 in head.

Scales ctenoid (Pl. XIX, E and F), predorsal scales 1.0–1.2 (Ad.) times as long as wide. Mucus canal long and narrow. Very young fishes have cycloid dorsal scales, the denticulations develop with growth (Pl. XIX, A–E), l.r. 44–48, l.tr. 15–16; 4–5 cheek scales, 15–17 predorsal to above the hind margin of the head.

Colour.—Greenish to dull brown above, silvery below. Sometimes indistinct longitudinal streaks. Opercles usually with golden blotch.

Localities.—Walfisch Bay, Lambert's Bay, Table Bay, False Bay, Cape Agulhas, Port Beaufort, Knysna, Plettenberg Bay, Port Elizabeth, Port Alfred, Great Fish Point, East London, Mazeppa Bay, Durban, Sinkwazi. Also in tidal rivers.

Length.—Up to 405 mm.

Fifty-five specimens, from 50 mm. up, examined.

It appears to be reasonably certain that our specimens should be assigned to *capito* Cuv.

I have received a number of specimens from the Zoological Station, Naples, among which is one very likely conspecific with the species I have here designated *capito*. Specimens of *capito*, *auratus*, and *saliens* were included, but the preservative employed in the package had unfortunately destroyed all the labels, so that I am unable to say which specimen was actually identified in Naples as *capito*. I have also examined a specimen of reputed *capito* from Holland, but this is not conspecific; if it is correctly named, our species is not *capito*. This specimen has pectoral 1.35 in head and has no axillary pectoral process, and in general outlines resembles *auratus* Risso rather than *capito* or *saliens*.

Since, as is indicated below, I find it impossible from the literature to find any certain basis for the differentiation of *saliens* from *capito*, the most that can be said is that our specimens are probably identical with the latter species.

Boulenger identified a specimen (No. 12048) in the S.A. Museum as *capito* Cuv. He also identified as *saliens* Risso another specimen (No. 10157, from Table Bay), which I cannot by any means whatsoever differentiate from the former; the latter even possesses a well-developed scaly process in the pectoral axil, the absence of which in *saliens* Boulenger (*loc. cit.*) makes his Key characteristic for differentiation from *capito*.

Günther (*loc. cit.*) appears to have been satisfied that specimens from the Cape were identical with the European *capito*, but he remarked that Smith's specimens were badly stuffed, and of little use as types or for comparison—a fact which has recently been confirmed by a private communication from Mr. Norman of the British Museum.

If one may judge from the literature, a certain amount of mystery surrounds the identity of *saliens*. Günther (*loc. cit.*, p. 443) did not appear to be very certain of this species, and the features upon which he based his differentiation of *saliens* from *capito* (and from *auratus*) are inconstant and unreliable. Boulenger (F.W.F. Africa, *loc. cit.*) was obviously uncertain of *saliens*, and it may be remarked that this is the only African *Mugil* species of which he gives no figure. Barnard has evidently merely followed Boulenger in regard to the differentiation of *saliens* from *capito*.

Athanassoupoulos (*loc. cit.*) has endeavoured to elucidate this,

The Fishes of the Family Mugilidae in South Africa. 617

but his conclusions have shed little light upon the problem, for he relies in his Key chiefly upon the supposed fact that the mouth of *saliens* is more convex than that of *capito*, which is at best of little practical value, and unlikely to be constant even were more precise details provided. This author has also proposed to use as diagnostic features certain dimensional relationships which would have to be tested over a wider range of stadia before their value can be accepted.

Differentiation between *capito* and *saliens*, based solely upon the presence or absence of the axillary process of the pectoral, has been accepted by many systematists, but does not appear to be absolute. Most authors state that this axillary process is present in *capito* but absent in *saliens*, whereas Athanassoupoulos says that the latter species actually has a short process in the axil. As far as the South African specimens are concerned, a large process is apparent only in adults of *capito*. Juveniles have a very short process in the axil, and in a long and regular series of all stadia it may be seen that the size and length of this process increases regularly with age. In preserved juvenile and half-grown specimens it is often exceedingly difficult to be certain whether the process is present or not, and so inconstant and unreliable is this feature that I should not venture to use it as a sole basis for differentiation in the present case.

Not only does it appear certain that *saliens*, as distinct from *capito*, does not occur in our area, but I have come, from the literature at my disposal, to doubt the validity of that species. At all events, it would appear that those who have specimens of *capito*, and of reputed *saliens*, must present stronger evidence for the maintenance of the latter species than has hitherto appeared. Athanassoupoulos states that the basal scale of the first dorsal of *saliens* is shorter than the base of this fin, whereas in *capito* it is slightly shorter to slightly longer than the base, but he has given no quantitative data. This may eventually prove to be the key feature of any established differentiation. Among the specimens from Naples are two which agree in some respects with the general diagnosis of *saliens*. There is no process, or a very small one, in the axil, and the preorbital is deeply notched; the mouth is more obtuse, and the scale at the base of the first dorsal is relatively longer than in *capito*, while the pectorals are 1.3-1.35 in head. I cannot venture to make any statement about the identity of these specimens, but they are certainly different from any species from South Africa which I have examined.

M. capito appears to be found throughout the greater part of our area, being most abundant on the West coast and round the Cape as far

as Port Beaufort, in which parts it is the most important *Mugil* species.

It is distinguished from other South African species by the scale-count, the very short pectorals, the scarcely obtuse mouth, and the well-exposed maxillary.

Mugil tricuspidens n. sp.

(Plates XVII, A, F, G; XVIII, G, H.)

1849. Smith, Illus. S.A. Pisces, pl. xxx, fig. 1 (*capensis* C. & V.).

1853. Pappe, Edible Fish. C.G.H., p. 27 (*multilineatus*).

1861. Günther, Cat. Fish. B.M., vol. iii, p. 443 (*saliens* part).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 308 (*auratus* part).

Depth 4.0–4.5, length of head 4.0 (J.)–4.4 (Ad.) in length of body. Eye 4.6 (J.)–5.4 (Ad.), snout 3.4–3.7, interorbital width 2.0–2.5, post-orbital length 1.8–2.0 in length of head. Adipose eyelids rudimentary, scarcely visible in juveniles, clearly visible in adults, posterior better developed. Nostrils $\frac{1}{6}$ of eye diameter apart, anterior midway between front margin of eye and tip of snout profile. Lower margin of preorbital undulate, lower and hinder edge serrate. End of maxilla clearly visible. Angle of lower jaw 103–108°, outline of jaw rounded. Symphysial knob indistinctly double. Upper lip thin, width at apex of snout 3–4 in eye. Flattened, apically dilated, recurved, tricuspid teeth (Pl. XVII, G) in a single series in upper jaw: in juveniles the teeth are more dilated, and the central cusp is spatulate (Pl. XVII, F). When viewed in fresh specimens, usually the central cusp only shows. The lip must be pushed back before the basal cusps are to be seen. The relatively large size of the teeth, and the wide spacing of the central cusps are distinctive characters. Lower jaw edentate. Villiform teeth on vomer, pterygoids, and tongue. Palatines edentate. In adults the membrane of the roof of the mouth, and of the tongue, have close-set, apically dilated, tricuspid cilia.

D IV + I, 8. First dorsal inserted 1.0 (J.)–1.07 times as far from base of caudal as from tip of snout, 1.25–1.35 times as far from hind margin of the mid-caudal rays as from tip of snout. First spine 1.9–2.1, base of first dorsal 2.1–2.5 in head. Distance from origin of first to origin of second dorsal 1.0–1.1 times head. First dorsal inserted above the 15th or 16th, second above the 28th or 29th lateral scale. Pointed sheath scale extends behind origin of first dorsal, 2.5–2.8 in head, 5.4–5.8 in distance from snout tip to origin

The Fishes of the Family Mugilidae in South Africa. 619

of first dorsal, 2.4–2.8 in distance from origin of first to origin of second dorsal. Second soft ray 1.5–1.8, base of second dorsal 2.6–2.8 in head. Last ray longer than penultimate, fin anteriorly elevated, sub-falcate, edge concave. Second dorsal scaly only anteriorly and basally.

A III, 9, inserted slightly in advance of second dorsal, below the 27th–28th lateral scale. Second ray 1.6–1.8 in head, last ray longer than penultimate; edge of fin concave; scaly.

P 18, 1.2–1.3 in head, tip reaches to the 11th or 12th lateral scale, inserted 1.6–2.0 times as far from the ventral as from the dorsal

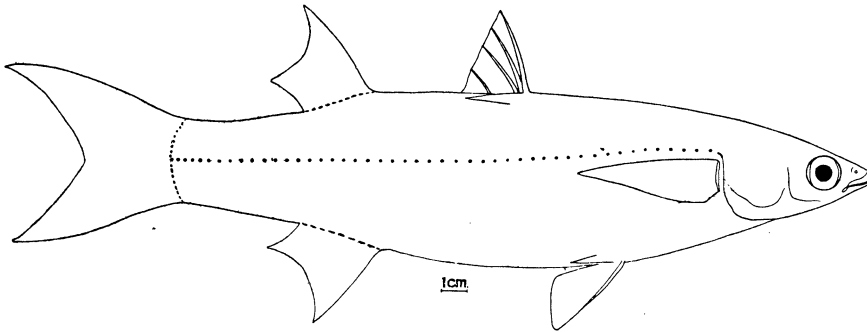


FIG. 10.—*Mugil tricuspidens* n. sp. (see note, fig. 3).

profile. No marked axillary scale in juveniles; a short, blunt, curved scale in adults, movable only in fresh specimens.

Ventrals 1.7–1.8 in head, inserted below midway between base of pectoral and origin of first dorsal, edge of fin gently rounded. Axillary scale 3.1–3.5 in head.

Caudal forked, upper lobe longer in adults, mid-rays 1.7–1.9 in head.

Scales ctenoid: mucus canal short, oblique. Predorsal scales nearly as wide as long (Pl. XVIII, G and H), l.r. 43–48, l.tr. 14–15. Four cheek scales, 16–17 predorsal to above hind margin of head.

Colour.—Greenish above, silvery on sides and below. 7–8 very distinct longitudinal dusky streaks corresponding with the scale rows, visible in all but the very youngest stadia. Opercles golden or bronzy.

Localities.—Mossel Bay, Knysna River, Zwartkops River, Buffalo River, Mazeppa Bay, Durban.

Length.—Up to 550 mm.

Sixteen specimens, from 60 mm. in length up, examined.

Types, from Knysna, in the Albany Museum.

There is very little doubt that the specimens described by Smith

(*loc. cit.*), as *capensis* C. and V., belong to this species. The sole diagnostic feature in the description is the scale-count, which is valid also for *capito* or *saliens*. The figure, however, leaves no doubt about the identity with *tricuspidens*.

It may be noted that in A. Smith's pl. xxx, fig. 1 is below and fig. 2 above. Pappe (*loc. cit.*) had evidently not noticed this, for he has obviously confused *multilineatus* with *capensis*.

Boulenger (*loc. cit.*), presumably having seen both the type of *capensis* C. and V. and Smith's specimen, stated that this latter is not *capensis* C. and V. Günther (*loc. cit.*) accepted Smith's diagnosis, but regarded the latter species as identical with *euronotus* Smith, and stated that both are identical with *saliens* Risso.

The original description of *capensis* (C. and V., Hist. Nat. Poiss., vol. xi, p. 108) is so vague and brief that it is quite impossible even to guess what species was actually described.

I am therefore provisionally naming this *tricuspidens* n. sp., and must leave the final pronouncement of the validity of this step to some worker who may be able to examine adequate material, including the type of *capensis* C. and V.

As this species is normally estuarine, it is possible that it may prove to be endemic.

It is well differentiated from our other species by numerous features, chiefly by the relatively large tricuspid teeth, while the characteristic longitudinal stripes show up well even in preserved specimens.

It may be noted that net fishermen at Knysna constantly distinguish this species as the "Streepharder," naming large specimens (unfortunately in common with large specimens of all species) "Springer."

M. tricuspidens does not appear to be anywhere very numerous nor specially gregarious, and, so far as I am aware, occurs only in tidal estuaries. Juvenile specimens are seldom encountered, and since the species is characterised by most extraordinary leaping powers, large numbers are rarely taken by the nets. I have at night in a boat frequently pursued adults of this species, which are exceedingly difficult to capture. When startled, large adults will leap anything up to 40 feet, rising 7 to 8 feet in the air, and the leap may be repeated six or seven times. The species may be clearly distinguished at night, when in the air, by means of a powerful light, the longitudinal stripes showing up clearly against the light silvery body.

Specimens occasionally jump into a boat which carries a light; large adults weighing 5½ lb. have been taken in this manner, and I

The Fishes of the Family Mugilidae in South Africa. 621

have known a man to be knocked from his seat by the impact of one of these fishes on his chest.

At Knysna ripe females are encountered in the late autumn and early spring. Specimens are usually encountered at night in shallow water on mud-banks, and are exceedingly shy. I have occasionally been able to approach specimens which have continued to circle over the mud, clearly visible in the light of the lamp, but the least movement of the light, or any noise in the boat, results in the characteristic leap. On one occasion a dozen or more large specimens broke water round the boat, and for some seconds the air appeared to be full of silvery bodies, and the plunging leaps produced a considerable volume of sound.

Mugil seheli Forsk.

(Plates XVI, C, and XVIII, C, D.)

1888. Day, Fish. India, p. 355.

1916. Boulenger, F.W.F. Africa, vol. iv, p. 91, fig. 53.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 252.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 306.

Depth 3·8, length of head 3·8 in length of body. Eye 4·5, snout 4·2, interorbital width 2·4, and postorbital length 1·8 in length of head. Adipose eyelids rudimentary. Nostrils $\frac{1}{4}$ of eye diameter apart, anterior nearer the profile of the tip of the snout than the anterior margin of the eye. Lower margin of preorbital bent, notched, and serrate; scaly. Maxilla completely concealed. Angle of lower jaw 103°, outline of jaw angular. Upper lip thin, width at apex of snout 4 in eye. Symphysial knob double. No teeth in jaws visible. Vomer with traces of fine teeth, tongue with patches of villiform teeth. Palatines edentate. Exposed area on chin very short and narrow, would probably increase with age.

D IV + I, 8. First dorsal inserted 1·1 times as far from caudal base as from the tip of the snout, 1·4 times as far from the tip of the mid-caudal rays as from the tip of the snout. First spine 2·1, base of first dorsal 2·9 in head. Distance from origin of first to origin of second dorsal 1·05 in head. First dorsal inserted above the 13th, second above the 26th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2·4 in head, 2·1 in distance from origin of first to origin of second dorsal, and 4·2–5 in distance from origin of first dorsal to tip of snout. Longest soft ray shorter than the ventral fin and than the distance from hind margin of head to the

centre of the eye, 1.8; base of second dorsal 2.7 in head. Last ray longer than penultimate, fin scarcely falcate anteriorly, edge moderately concave. Soft dorsal scaly.

A III, 9. Inserted slightly in advance of second dorsal, below the 25th lateral scale. Longest ray 1.7 in head, shape of fin similar to that of second dorsal; scaly.

P 18, 1.1 in head, tip reaches to the 13th lateral scale, fin inserted 3.3 times as far from the ventral as from the dorsal profile. Axillary scale long and pointed, 3.2 in length of head. Most of fin scaled.

Ventrals 1.6 in head, longer than longest dorsal ray, inserted below

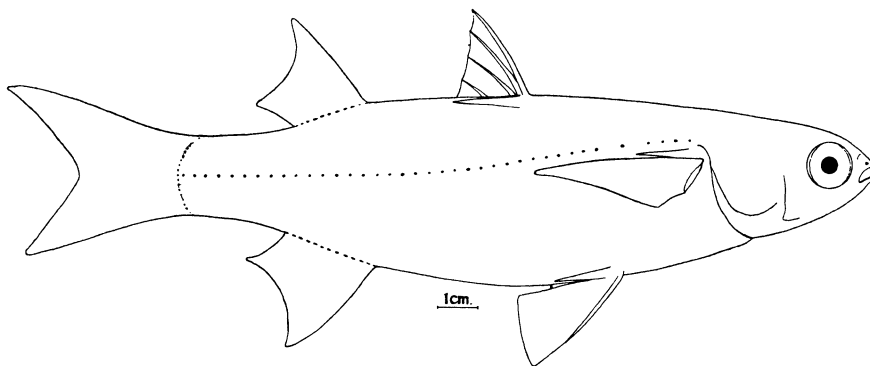


FIG. 11.—*Mugil seheli* Forsk. (see note, fig. 3).

midway between hind margin of head and origin of first dorsal or slightly nearer the former. Edge of fin gently rounded. Axillary scale 3 in head. Fin almost completely scaly.

Caudal deeply forked, upper lobe longer, mid-rays 1.7 in head; scaly.

Scales more or less cycloid, traces of denticulations on exposed area. Mucus canal long and narrow (Pl. XVIII, C and D). Predorsal scales as wide as long. Lat. ser. 39–41, l.tr. 14, 3 cheek scales, 14 predorsally to above the hind margin of the head.

Colour.—Silvery, darker above. Axil of pectoral black.

Locality.—Durban, Chilka Lake, Bay of Bengal.*

Length.—Up to 170 mm.

Three specimens, from 167 mm. in length up, examined.

Judging from the literature many authors are uncertain of the diagnosis of *seheli*. The majority agree in a scale-count of 38–42 and in stating that the maxillary is hidden. Fowler (Proc. Ac. Nat. Sci. Phil., 1925, vol. lxxvii, p. 209) describes as *seheli* two specimens

* A specimen kindly lent by the Director of the Indian Museum, Calcutta.

The Fishes of the Family Mugilidae in South Africa. 623

from Delagoa Bay, and states that the scales are 33–35, but omits to mention whether the maxillary is hidden or exposed. These specimens can hardly be *seheli*; the description agrees closely with that of *strongylocephalus* Gnthr., and it is possible that Fowler may have overlooked the adipose eyelids, although in the same paper he describes a specimen of this latter species (as *longimanus* Gnthr.) from the same locality. (But see note under *canaliculatus*.)

M. caeruleomaculatus Lac. is by many authors held to be a synonym of *seheli*. I have, however, examined a specimen of the former species from India,* and it is quite clearly distinct.

M. seheli is not very abundant in our area, nor does it appear to extend south of Natal. It is apparently widely distributed in the Indo-Pacific.

Mugil buchanaani Blkr.

(Plates XVI, D, and XX, C, D.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 446 (*ceylonensis*).

1888. Day, Fish. India, p. 358.

1916. Boulenger, F.W.F. Africa, p. 93, fig. 55 (*ceylonensis*).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 305 (*ceylonensis*).

1928. Fowler, Fish. Oceania, p. 123.

Snout very broad and short, bluntly rounded anteriorly. Depth 3.3–3.7, length of head 3.3 (J.)–4.0 (Ad.) in length of body. Eye 3.2 (J.)–5 (Ad.), snout 3.5 (J.)–4.0 (Ad.), interorbital width 2.0–2.3 (J.), and postorbital length 1.7–1.9 in length of head. Adipose eyelids rudimentary, better visible in adults. Nostrils $\frac{1}{3}$ of eye diameter apart, anterior as far from profile of snout tip as posterior from anterior margin of orbit. Lower margin of preorbital slightly bent, not, or slightly, notched; end truncated, lower and hinder edge serrated, scaly. End of maxilla completely concealed. Angle of lower jaw 110–122°, outline of jaw almost angular. Symphyseal knob double. Upper lip thin, width at apex of snout 5 in eye. Very minute ciliiform teeth in a single series in each jaw in very young specimens, none visible in half-grown or adults. Vomer and palatines edentate. Pre-vomerine groove distinct. Villiform teeth on pterygoids and round the anterior margin of the tongue. Space between rami of mandibles on chin almost absent in juveniles, gradually enlarges with age; long and wide in large adults.

D IV+I, 8. First dorsal inserted 0.90 (J.)–1.15 (Ad.) times as

* Kindly lent by the Director of the Indian Museum, Calcutta.

far from the caudal base as from tip of snout, 1.23 (J.)–1.43 times as far from the hind margin of the mid-caudal rays as from the tip of the snout. First spine 1.7–1.9, base of first dorsal 2.0–2.2 in head. Distance from origin of first to origin of second dorsal 1.0–1.2 (J.) in head. First dorsal inserted above the 9th–12th, second above the 20th–23rd lateral scale. Pointed sheath scale extends behind the origin of the first dorsal 2.6–2.9 (J.) in head, 2.4–2.6 in distance from origin of first to origin of second dorsal and 5.0–6.6 in distance from origin of first dorsal to tip of snout. Second soft ray longer than ventrals, and than distance from hind margin of head to centre of eye, 1.25–1.4 (J.); base of second dorsal 2.6–3 (J.) in head. Last ray

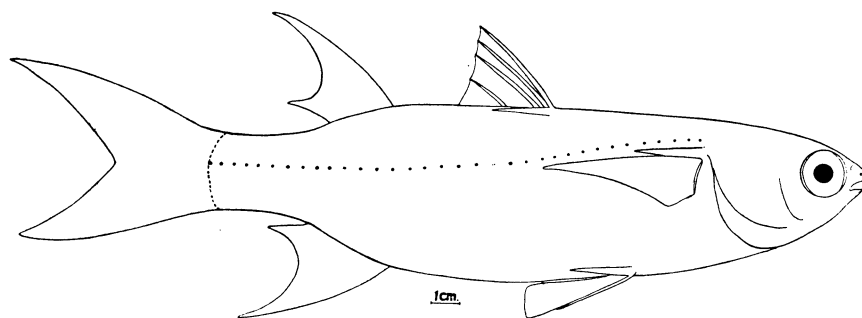


FIG. 12.—*Mugil buchanani* Blkr. (see note, fig. 3).

longer than penultimate; in adults the fin is anteriorly elevated, falcate, edge deeply concave. Second dorsal densely scaled.

A III, 9. Inserted opposite origin of second dorsal. Second ray 1.2–1.4 (J.) in head, last ray longer than penultimate; in adults the fin is anteriorly elevated, falcate, edge deeply concave, densely scaled.

There is considerable alteration in the shape of the soft dorsal and anal fins with growth. In very young specimens (< 100 mm.) the anterior rays are fairly long, but the fin is not markedly falcate, since the middle rays are relatively longer than in the adult, and the edges of the fins are feebly concave. As the size of the fish increases, the anterior rays become relatively longer and the middle rays shorter, the fin assuming the anteriorly falcate shape when the length of the fish is more than ± 120 mm. The scaling of the fins also increases from the very young to this size. In the former the basal scaling only is plain, there being apparently a mere sprinkling of light scales over the distal portions of the fins.

P 17–18, 1.0–1.15 (J.) in head, tip reaches 11th–12th lateral scale,

The Fishes of the Family Mugilidae in South Africa. 625

inserted 2·8–3·3 times as far from ventral as from dorsal profile. A large scaly axillary process, 2·8–5·2 (J.) in length of head.

Ventrals 1·5–1·7 in head, inserted below midway between hind margin of head and origin of first dorsal, or nearer the latter; edge of fin truncate. Axillary scale 2·8–3·4 in head.

Caudal deeply forked, upper lobe longer, mid-rays 1·7 (J.)–2·0 in head, densely scaled.

Ventrals and pectorals scaly basally.

Scales cycloid, ventral scales very finely denticulate. Longitudinal length of predorsal scales 1·1 times width (Pl. XX, C and D), l.r. 33–36, l.tr. 13; 9–11 predorsal to above hind margin of head, 3–4 cheek scales.

Colour.—Bright silvery, darker above. Indistinct longitudinal stripes. Axil of pectoral black, except in very small specimens.

Localities.—Knysna, Durban, Chinde, Celebes.*

Length.—Up to 385 mm.

Eleven specimens, from 68 mm. up, examined.

It appears to be fairly certain that *ceylonensis* Gnthr. is a synonym of *buchanani* Blkr. This was Day's opinion (*loc. cit.*) after examining the types of both species, with which Fowler (*loc. cit.*) is apparently in agreement.

This species has, beyond the early juvenile stages, a characteristic shape, which distinguishes it at a glance from all other South African species; *buchanani* and *compressus* are the only two species with markedly falcate dorsal and anal fins. *M. buchanani* is easily distinguished from the latter by the very blunt rounded snout, by the shape and length of the ventrals, and by the concealed maxilla.

It is probably widely distributed in the Indo-Pacific area. From the outlines this is a swift pelagic species.

Probably many specimens now assigned to *caeruleomaculatus* Lac. will be found to be conspecific with *buchanani* (see notes under *robustus*).

Mugil compressus Gnthr.

(Plates XVII, B, and XX, E, F.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 451.

1911. Gilchrist and Thompson, Ann. S.A. Mus., vol. xi, p. 42 (*diadema*).

1916. Boulenger, F.W.F. Africa, vol. iv, p. 94 (*macrolepis* part).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 309 (*diadema*).

* A specimen, 107 mm. in length, kindly lent by Dr. de Beaufort, Curator of the Zool. Museum, Amsterdam.

Depth 4.0-4.3, length of head 4.0-4.4 in length of body. Eye 5.1-6, snout 3-3.4, interorbital width 2.0-2.2, length of postorbital part of head 1.7-1.8 in length of head. Adipose eyelids rudimentary, visible in adults. Nostrils $\frac{1}{2}$ of eye diameter apart, anterior slightly behind midway between anterior margin of orbit and profile of snout tip. Lower margin of preorbital curved, not, or very slightly, notched; serrate, scaly. End of preorbital obliquely truncated, edge slightly convex. End of maxilla clearly visible. Angle of lower jaw 105° , outline of jaw angular. Symphysial knob double. Upper lip thin, width at apex of snout 3 in eye. Very small recurved slightly compressed teeth in two series in upper jaw, the posterior series well back. Lower jaw edentate. Villiform teeth on pterygoids, and in patches round the anterior margin of the tongue. Vomer and palatines edentate. Exposed space between the rami of the mandibles long and narrow.

D IV + I, 8. First dorsal inserted 0.95-1.05 times as far from tip of snout as from caudal base, 1.25 times as far from the hind margin of the mid-caudal rays as from the tip of snout. First spine 1.6-1.7, base of first dorsal 2.1-2.2 in head. Distance from origin of first to origin of second dorsal 0.9-1.2 times head. First dorsal inserted above the 10th-11th, second above the 20th-22nd lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.8-3.3 in head, 6-6.8 in distance from origin of first dorsal to snout tip, 3.2-3.5 in distance from origin of first to origin of second dorsal. Highest soft ray longer than distance from hind margin of head to centre of eye, 1.2-1.3; base of second dorsal 2.6-2.9 in head. Last ray longer than penultimate, fin anteriorly elevated, falcate, edge deeply concave. Second dorsal densely scaled. First ray much longer than distance from hind margin of head to centre of eye.

A III, 9. Inserted slightly in advance of second dorsal, below the 19th-21st lateral scale. Second ray 1.1 in head, last ray longer than penultimate, fin anteriorly elevated, falcate, deeply concave. Densely scaled.

P 16, 1.2 in head, tip reaches 8th-9th lateral scale, inserted 2.6-3 times as far from the ventral as from the dorsal profile. No axillary scale.

Ventrals 1.25 in head, longer than head without snout, inserted below 1.3-1.4 times as far from first dorsal origin as from hind margin of head. First and second rays elongate, fin sub-falcate. Axillary scale 3.8 in head.

Caudal deeply forked, upper lobe longer, mid-rays 1.6-1.7 in head

The Fishes of the Family Mugilidae in South Africa. 627

Scales large, predorsal very finely denticulate, ventral scales more distinctly so. Predorsal scales as wide as long (Pl. XX, E and F), l.r. 29–32 (Günther 28), l.tr. 11, 10–11 predorsal to above hind margin of head. Five cheek scales.

Colour (Preserved).—Uniform light brown; silvery in life. Hind edge of scales dark.

Localities.—Port Elizabeth, Durban, St. Lucia Bay, Kosi Bay.

Length.—Up to 600 mm.

Five specimens, all adults (one stuffed, Port Elizabeth Museum), examined.

It has earlier been indicated that the majority of Günther's descriptions of *Mugil* species (*loc. cit.*, pp. 417–460) are scarcely full enough

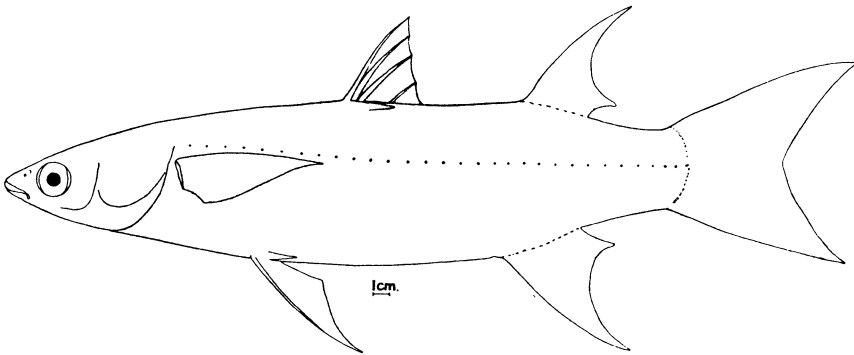


FIG. 13.—*Mugil compressus* Gnthr. (see note, fig. 3).

to be of much diagnostic value. But that of the Australian species, *compressus* Gnthr., is an exception. I have very little hesitation in pronouncing *diadema* G. and T. synonymous. Nevertheless, as I have seen no Australian specimens, this diagnosis is provisional only.

It must be confessed that I was led to search for some Indo-Pacific form, with which *diadema* might prove identical, by the outlines of this species, which indicate a swift, pelagic fish, possessing great leaping powers; likely to be widely distributed, but difficult to capture.

In certain minor details only does the diagnosis of *compressus* differ from that of *diadema*. Günther states that the former has 28 series of scales: *diadema* has 29–32; this is well within normal limits of variation. The exposed surface on the chin of *compressus* is stated to be very short and narrow, in *diadema* it is long and narrow. I have found that the extent of this exposed area varies in one species, and increases with age. Long preservation in spirits

might account for the highly compressed body of Günther's specimen, a feature he regards as significant, but which I have observed in old spirit-preserved specimens of all species. In no significant feature does *compressus* differ from *diadema*.

The outstanding characteristics which, with the small number and large size of the scales, immediately distinguish *compressus* from all other species are the very elongate ventrals, longer than the head without the snout, inserted much nearer to the hind margin of the head than to the origin of the first dorsal (see note under ventral fins, p. 595).

Fowler (Fishes Oceania, Mem. B.P. Bishop Mus., 1928, vol. x, p. 125) considered *compressus* identical with *macrolepis*. Boulenger (*loc. cit.*) originally considered *diadema* synonymous with *macrolepis*, but later recognised (*fide* Barnard, *loc. cit.*) the former as distinct. Fowler has evidently missed the significant paragraph about the ventrals in the original description of *compressus*. In 1926 Fowler (Proc. Ac. Nat. Sci. Phil., vol. lxxvii, p. 210) suggested that *diadema* is a synonym of *oligolepis* Blkr., which is not likely. It is scarcely possible that Fowler's specimen is a juvenile *compressus*, since he stated that the pectoral was 1.6 and the ventral 1.4 in head, neither of which agrees with this species.

It may be remarked that the elongate anterior dorsal, anal, and ventral rays are probably marked only in advance of the early juvenile stages. I have seen no young specimens, but these will probably prove difficult to distinguish from similar stadia of *macrolepis*. The relative length of the scale at the base of the first dorsal will probably be of use in distinguishing juveniles.

Mugil macrolepis Smith.

(Plate XX, A, B.)

1849. Smith, Illus. S.A. Pisces, pl. xxviii, fig. 2.

1861. Günther, Cat. Fish. B.M., vol. iii, p. 447 (*smithii*).

1916. Boulenger, F.W.F. Africa, vol. iv, p. 94, fig. 56.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 309 (pl. xii, fig. 2, *non macrolepis*).

Body of characteristic shape, usually with a false appearance of extra width between the anal and the soft dorsal fins.

Depth 3.6–3.8, length of head 3.8 in length of body. Eye 4.1–4.3, snout 3.5–4, interorbital 2.2, postorbital length 1.9–2 in length of head. Adipose eyelids rudimentary but clearly visible in adults.

The Fishes of the Family Mugilidae in South Africa. 629

Nostrils $\frac{1}{8}$ of eye diameter apart, anterior midway between anterior margin of eye and profile of snout tip. Lower margin of preorbital bent downwards; not, or scarcely, notched; lower and hinder edge serrate. End of maxilla exposed. Angle of lower jaw $105-108^\circ$, outline of jaw gently rounded, symphysial knob single. Upper lip thin, width at snout apex 5 in eye. Very small, slightly spatulate teeth, with a notch at each side of apex, in two rows in upper jaw; teeth fairly close-set in each row, the hinder row well behind the anterior. Villiform teeth on vomer, pterygoids, and anterior margin of tongue. Lower jaw and palatines edentate. Groove before vomer distinct. Exposed area on chin fairly short and narrow.

D IV + I, 8. First dorsal inserted 1.04–1.08 times as far from the

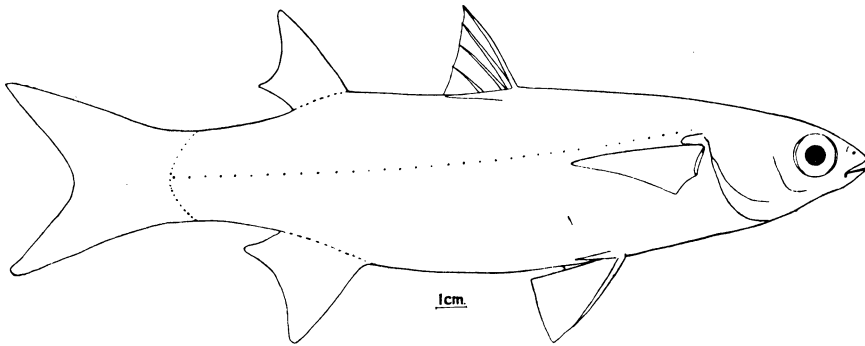


FIG. 14.—*Mugil macrolepis* A. Smith (see note, fig. 3).

tip of the snout as from caudal base, 1.15–1.25 times as far from the hind margin of the mid-caudal rays as from tip of snout. First spine 1.7, base of first dorsal 1.9–2.1 in head. Distance from origin of first to origin of second dorsal 1.0–1.1 in head. First dorsal inserted above 13th–14th, second above the 24th–25th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.5 in head, 5–5.8 in distance from snout tip to origin of first dorsal, 2.3–2.5 in distance between origin of first and origin of second dorsal. Second soft ray shorter than hind margin of head to centre of eye, 1.7, base of second dorsal 3.1 in head. Last ray longer than penultimate, fin little elevated anteriorly, edge gently concave. Second dorsal completely scaly in adults.

A III, 9, inserted slightly in advance of second dorsal, below the 23rd lateral scale. Second ray 1.7 in head, last ray longer than penultimate, in shape resembles second dorsal. Completely scaled.

P 16, 1.25–1.35 in head, tip reaches to the 10th–11th lateral scale, inserted twice as far from the ventral as from the dorsal profile. No axillary scale, or a very short blunt one, in adults.

Ventrals 1.5 in head, shorter than head without snout, inserted below 1.0–1.2 times nearer hind margin of head than origin of first dorsal. First ray very slightly longer than remainder, edge of fin almost straight. Axillary scale 3–3.5 in head.

Caudal slightly forked, mid-rays 1.8–1.9 in head.

Scales finely ctenoid; predorsal scales about 1.2 times as long as wide. Mucus canal long and narrow (Pl. XX, A and B), l.r. 33–35, l.tr. 12; 3 cheek scales, 12 predorsal to above hind margin of head.

Colour.—Bright silvery, slightly darker above.

Locality.—Mazepa Bay, Durban, Isipingo River, Sinkwazi Lagoon, Kosi Bay.

Length.—Up to 305 mm.

Thirty-four specimens, 66 mm. in length up, examined.

There seems to be little doubt about the identity of the specimens described above.

This is a very characteristic species. It is easily distinguished from all others from South Africa by the number of scales, by the absence of the long scaly process from the axil of the short pectoral, and by the exposed maxillary.

Boulenger (*loc. cit.*) considered *troscheli* Blkr. a synonym of *macrolepis*, while Fowler (Fishes Oceania, Mem. B.P. Bishop Mus., 1928, vol. x, p. 124) placed both *troscheli* and *borneensis* in the synonymy of *macrolepis*. On the other hand, Weber and de Beaufort (Fish. Indo-Aust. Archip., 1922, vol. iv, pp. 248, 249) considered *troscheli* and *borneensis* distinct from one another, and (evidently, since they made no mention of it) also from *macrolepis*. A careful analysis of the various descriptions appears to support Fowler's conclusion. If this is correct, then *macrolepis* is widely distributed in the Indo-Pacific. Probably *olivaceus* Day (Fish. India, p. 357) is not different.

M. macrolepis appears to be fairly abundant on the Natal coast.

Mugil canaliculatus n.sp.

(Plates XVI, B; XVII, D; XVIII, E, F.)

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 303 (*speigleri*); p. 308 (*auratus*, part).

Depth 3.9–4.3, length of head 4.0 (J.)–4.5 in length of body. Eye 4.0 (J.)–4.6, snout 3–3.9, interorbital width 2.3–2.5, and postorbital

The Fishes of the Family Mugilidae in South Africa. 631

length 1.5–2.0 in length of head. Adipose eyelids visible even in juveniles, clearly visible in adults, posterior better developed than anterior, covering almost half of iris posteriorly. Nostrils $\frac{1}{6}$ of eye diameter apart, anterior nearer tip of snout profile than front margin of eye. Preorbital deeply notched and bent downwards, end dilated and rounded, lower and hinder edges serrate. End of maxilla well exposed. Angle of lower jaw 108–112°, outline of jaw angular. Symphyseal knob double. Upper lip thin, width at apex of snout 3–4 in eye. Very fine recurved, compressed, apically truncated teeth (Pl. XVII, D) in a single series in upper jaw; juvenile and adult teeth identical. Lower jaw edentate. Villiform teeth on vomer, palatines, pterygoids, and tongue. Exposed area on chin fairly long.

D IV + I, 8. First dorsal inserted 1.0–1.05 times as far from caudal base as from tip of snout, 1.25–1.3 times as far from the hind margin of the mid-caudal rays as from the tip of the snout. First spine 1.8–2.1, base of first dorsal 2.4–2.8 in head. Distance from origin of first to origin of second dorsal 0.95–1.1 times head. First dorsal inserted above the 13th–14th, second above the 24th–25th lateral scale. Pointed sheath scale extends behind the origin of the first dorsal 2.0–2.4 in head, 2.0–2.4 in distance from origin of first to origin of second dorsal, 4.3–4.9 in distance from origin of first dorsal to tip of snout. Second soft ray 1.6–1.7, base of second dorsal 2.2–2.6 in head. Last ray longer than penultimate, fin anteriorly very slightly elevated, edge gently concave. Second dorsal scaly only anteriorly and basally.

A III, 9. Inserted only slightly in advance of second dorsal, below the 23rd–25th lateral scale. Longest ray 1.7–1.8 in head, fin not much elevated anteriorly; scaly.

P 16, 0.95–1.15 (J.) in head, tip reaches to the 10th lateral scale, inserted 1.9–2.7 times as far from the ventral as from the dorsal profile. No axillary scale in juveniles, a very small obscure curved scale in adults.

Ventrals 1.5–1.6 in head, inserted below 1.1–1.3 times further from the hind margin of the head than from the origin of the first dorsal. Edge of fin almost truncate. Axillary scale 2.8–3.0 in head.

Caudal moderately forked, upper lobe longer in adults, mid-rays 1.7–1.9 in head.

Scales, dorsal weakly, ventral strongly, ctenoid. Predorsal scales slightly longer than wide, multicanalicate to about the third row down (Pl. XVIII, E and F). Canalisation appears to increase with

age, young fishes having 2-3, large adults up to 14 wavy canals on one scale. Lat. rows 36-39, l.tr. 13-14, 3-4 cheek scales, 13-14 predorsal to above the hind margin of the head.

Colour.—Dusky above, silvery below. Opercles dull.

Localities.—Knysna, Plettenberg Bay, Port Alfred, Great Fish Point, East London, Mazeppa Bay, Durban, Delagoa Bay. Also in tidal rivers.

Length.—Up to 285 mm.

Forty-three specimens, from 90 mm. up, examined.

Types, from Knysna, in the Albany Museum.

It is probable that this species must previously have been described, but I cannot yet with certainty assign it to any known species.

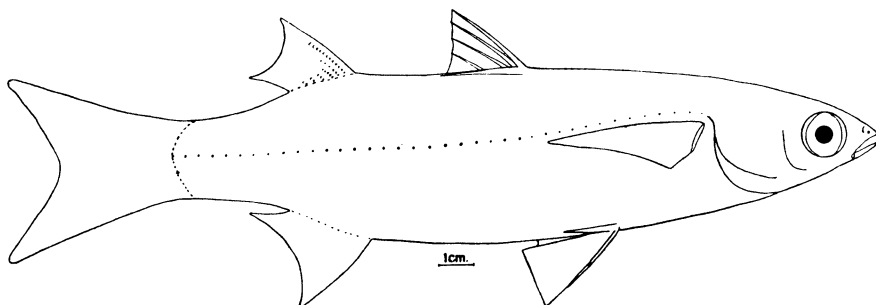


FIG. 15.—*Mugil canaliculatus* n. sp. (see note, fig. 3).

canaliculatus is very close to, if not actually identical with, *hoeferi* Stndnr., from Senegambia. Beyond the absence of the adipose eyelids in this latter species, there appears to be little difference between them. I have unfortunately been unable to obtain one of Steindachner's types for comparison, but Dr. Pietschmann of Vienna has kindly sent me an accurate drawing of one of the few remaining predorsal scales on the only scaled type of *hoeferi*, and this scale resembles those of *canaliculatus* in being multicanaliculate. Nevertheless, as I have not seen any of these West African types, and in view of the widely separated recorded areas of these species, it would appear better to maintain both for the present.

It is most likely that *canaliculatus* occurs in the Indo-Pacific, but I have not been able to recognise it from the descriptions of any species from this area. Barnard (*loc. cit.*) had identified one of the S.A. Museum specimens as *speigleri* Blkr., and others as *auratus* Risso. I have examined a specimen of *speigleri* from India, and *canaliculatus* is quite definitely distinct. I have also examined

The Fishes of the Family Mugilidae in South Africa. 633

specimens from Italy, among which were reputed *auratus*, and *canaliculatus*, while related, is certainly different. The latter has fewer scales, longer pectorals, and better developed adipose eyelids than the northern species.

It is probable that it is *canaliculatus* which Boulenger (F.W.F. Africa, p. 88) identified as *auratus* (from East London). Boulenger's figure of *auratus* (*loc. cit.*, fig. 50) might well pass for the former species. If the marked adipose eyelids and the scale-counts are overlooked, it would evidently be easy to confuse these two species, although I have forwarded a specimen to Mr. Norman of the British Museum, and he states that it is quite distinct from their specimens of *auratus*.

Fowler (Proc. Ac. Nat. Sci. Phil., 1925, p. 209) has described two specimens from Delagoa Bay as *seheli* Forsk., which cannot be that species, and are possibly *canaliculatus*.

M. canaliculatus is exceedingly abundant on the South and East coasts, at least as far as Delagoa Bay. It enters tidal rivers, but does not appear to ascend very far. At Knysna it may be seen that *canaliculatus* abounds up to about five miles from the mouth of the river; in the higher part of this area *tricuspidens* is also found, together with *cephalus*. Both of these latter species extend several miles farther up the river to the point where the water is only slightly saline. Beyond this stage, *cephalus* and *euronotus* are found.

M. canaliculatus does not appear to attain a large size. It is apparently only those species which are largely fluviatile, such as *cephalus* and *tricuspidens*, which grow very large.

At Knysna and Great Fish Point, ripe females of *canaliculatus* are observed during August and September.

M. canaliculatus does not apparently possess any marked leaping powers. This may have some connection with the markedly posterior insertion of the ventrals.

The canalisation of the scales, and the long pectorals, immediately distinguish this from all other South African species.

Mugil waigiensis, Q. and G.

(Plate XX, G, H.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 435.

1888. Day, Fish. India, p. 359, pl. lxxiii, fig. 4.

1916. Boulenger, F.W.F. Africa, vol. iv, p. 97, fig. 59.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 244.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 310.

? 1928. Fowler, Fishes Oceania, p. 124, fig. 27.

Dorsal profile flat, interorbital flat, head very depressed at occiput. Depth 4, length of head 3.1–3.3 in length of body. Eye 3.8–4.1, snout 3.0–3.6, interorbital width 2.1–2.2, and length of postorbital 1.9–2.1 in length of head. Adipose eyelids rudimentary. Nostrils 3.5 in eye diameter apart, anterior midway between profile of snout tip and anterior margin of eye. Lower margin of preorbital bent, not, or slightly, notched, serrated. End of maxilla exposed. Angle of mouth 95–97°, outline of lower jaw angular. Symphysial knob

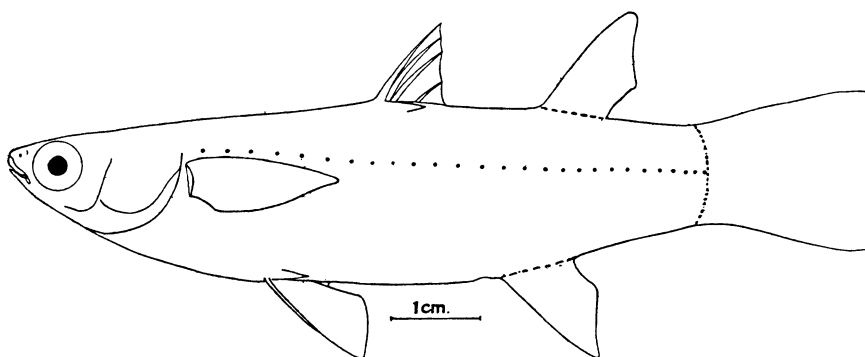


FIG. 16.—*Mugil waigiensis* Q. and G. (see note, fig. 3).

single. Upper lip thin, width at apex of snout $\frac{1}{5}$ of eye. No teeth in jaws or on palate. Exposed area on chin short and narrow.

D IV + I, 8, first dorsal inserted 1.1–1.18 times as far from tip of snout as from caudal base, 1.3 times as far from hind margin of mid-caudal rays as from tip of snout. First spine 1.9–2, base of first dorsal 3–3.5 in head. Distance from origin of first to origin of second dorsal 1.25 in head. First dorsal inserted above the 8th, second above the 16th–18th, lateral scale. Pointed sheath scale extends behind origin of first dorsal 3.3–4 in head, 6–8 in distance from origin of first dorsal to snout tip, 2.6–3.5 in distance from origin of first to origin of second dorsal. Second soft ray 1.6–1.8, base of second dorsal 3.6 in head. Edge of fin scarcely concave.

A III, 8, inserted in advance of second dorsal, below the 15th–16th lateral scale. Second ray 1.6 in head. Shape similar to dorsal.

P 16, 1.3 in head, tip reaches 7th–8th lateral scale, inserted 1.7–2.2 times as far from ventral as from dorsal profile. No axillary scale.

Ventrals 1.5–1.6 in head, inserted below 1.3 times as far from the

The Fishes of the Family Mugilidae in South Africa. 635

origin of the first dorsal as from hind margin of head. Edge of fin gently rounded. Axillary scale 3·5–4 in head.

Caudal almost truncate, lobes equal, mid-rays 1·3–1·4 in head.

Scales ctenoid, predorsal scales as long as wide, mucus canals short, lanceolate (Pl. XX, G and H); l.r. 26–28, l.tr. 9–10, 8 predorsal to above hind margin of head, 3 cheek scales.

Colour (Preserved).—Light brown, probably silvery in life. Pectorals partly or wholly dark. Vertical fins with dark margins. Dark longitudinal streaks.

Localities.—Chinde, Delagoa Bay.

Length.—Up to 100 mm.

Three specimens, from 44 mm. up, examined.

Easily distinguished from all other South African species by the small number of scales, together with the feebly emarginate caudal and the markings. Fowler's specimen from Delagoa Bay (Proc. Ac. Nat. Sci. Phil., 1925, vol. lxxvii, p. 209), described as *oligolepis* Blkr., does not appear to be very different from *waigiensis* (see notes under *oligolepis*). This author's figure of *waigiensis* (*loc. cit.*) differs in many respects from my specimens, and from most descriptions. The pectorals are shown to be about 1·8 in head, the first dorsal is inserted nearer the snout tip than the caudal base; the distance from the origin of the first to the origin of the second dorsal is about equal to the head, and there are 30 rows of scales: Day's figure (*loc. cit.*) is also rather singular in many respects. Barnard (*loc. cit.*) states that the maxilla is concealed. This is an error, if based on the S.A. Museum specimens.

The synonymy of this species appears to be somewhat extensive. A revision of material from all parts of its recorded area might show that several related species have been confused.

M. waigiensis is apparently widely distributed, and fairly common, throughout the whole of the Indo-Pacific region. It is not very common on our coasts.

From the outlines, this is probably a somewhat sluggish species.

Mugil oligolepis Blkr.

(Plates XXI, B, and XXII, C, D.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 452 (*melinopterus*, C. and V.?).

1888. Day, Fish. India, p. 358, pl. lxxvi, fig. 2.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 245, and p. 246 (*melinopterus*, C. and V.).

1925. Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxvii, p. 209.

Body moderately robust, well compressed posteriorly. Head broad and depressed, snout slightly rounded. Front profile of snout fairly blunt, formed by upper lip. Depth 3.5, length of head 4.0 in length of body. Eye 4.1, snout 3.5, interorbital 2.2, postorbital length 2.0 in length of head. Adipose eyelids moderate, anterior weak, posterior better developed, covering about $\frac{1}{3}$ of the iris. Nostrils $\frac{1}{4}$ eye diameter apart, anterior slightly behind midway between anterior border of eye and snout tip profile. Lower margin of preorbital bent slightly downwards, not notched, edge strongly serrate. End of maxilla well exposed. Angle of lower jaw 106° , outline of jaw angular, margins slightly rounded; symphyseal knob single. Upper lip fairly thin, width at snout apex 4 in eye. Minute curved teeth in a single close-set series in upper jaw; lower jaw, vomer, and palatines edentate. A few small patches of minute teeth on the outer margin of the tongue. The medio-longitudinal ridge on the tongue higher than in other species. Prevomerine groove not very convex posteriorly. Exposed area on chin lanceolate, long and narrow, with anterior constriction.

D IV + I, 8. First dorsal inserted exactly midway between snout tip and caudal base, 1.4 times farther from the tip of the mid-caudal rays than from the tip of the snout. First spine 1.6, base of first dorsal 2.0 in head. The spines are very much stronger than those of any other South African species. They are also more close-set, the 4th not remote from the others, being apically almost adnate to the 3rd (this may possibly be a deformity). When the spinous dorsal is folded down, the exposed parts of the spines, excepting the anterior margin of the first, are scaly. Distance from origin of first to origin of second dorsal equal to head. First dorsal inserted above the 9th, second above the 19th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.1 in head, 4.4 in distance from snout tip to origin of first dorsal, and 1.1 in the postorbital part of the head. Longest soft ray 1.6, base of second dorsal 2.7 in head. Last ray very little longer than penultimate, fin not falcate, edge gently concave. Second dorsal completely scaly, with heavy basal scaly sheath.

A III, 9, anterior half of base in advance of second dorsal, inserted below the 16th lateral scale. Longest ray 1.5 in head, last ray scarcely longer than penultimate, edge of fin gently concave. Densely scaly, especially basally.

P 15, 1.25 in head, tip reaches to the 8th lateral scale, inserted twice as far from the ventral as from the dorsal profile. No axillary scale.

The Fishes of the Family Mugilidae in South Africa. 637

Behind and below the upper part of the base of the fin is a small scaled cutaneous projection. Fin scaly on basal half.

Ventrals 1·4 in head, inserted below 1·1 times nearer hind margin of head than origin of first dorsal. Edge of fin almost truncate, very slightly emarginate. Axillary scale 3·5 in head. Interventral scaly process rather wide and heavy.

Caudal forked, mid-rays 1·7 in head.

Scales very finely ctenoid; predorsal scales slightly longer than wide, mucus canal rather narrow (Pl. XXII, C and D). On the lateral scales the mucus canal posteriorly communicates with a system of rudimentary canals or grooves, more or less arborescent. Lat. ser. 27,

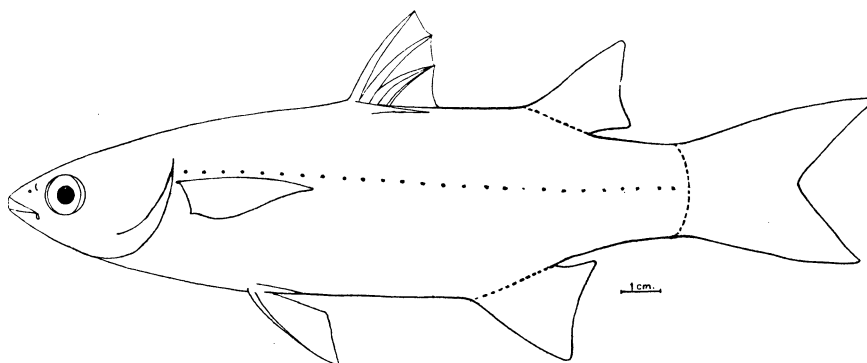


FIG. 17.—*Mugil oligolepis* Blkr. (see note, fig. 3).

l.tr. 10. Three cheek scales, 8–9 predorsal to above the hind margin of the head.

Colour.—Olive grey above, lighter below. Tips of dorsals darkish. Tip of upper lobe and hind margin of caudal dusky. Weak axillary spot. Faint streaks along the scale rows.

Locality.—Isipingo Lagoon, near the sea.

Length.—206 mm.

A single specimen examined.

A most rare and elusive species, sought for almost three years without success until recently. Not known as a separate species to the Indian netters in the neighbourhood of Durban.

This specimen is very probably conspecific with that described by Fowler (*loc. cit.*) from Delagoa Bay. Fowler's specimen had a narrower interorbital, while the markedly robust dorsal spines, obvious in my specimen, were not mentioned by him. Further, Fowler stated that the ventrals were 1·4 and the pectorals of his

specimen were 1.7 in head, but this may be an error. I have not seen any species of *Mugil* which has the pectorals so markedly shorter than the ventrals. Further, variation in length of the pectoral from 1.7 to 1.25 (my specimen) in head is far too wide for any one species.

Day's description and figure (*loc. cit.*) do not agree, and the latter, though most likely drawn from a juvenile, does not agree very well with my specimen. Nevertheless it is very likely that they are conspecific.

No descriptions of *oligolepis*, to which I have access, mention the posterior eyelid, which is very clear in my specimen.

It would not indeed be surprising to find that the synonymy of this species is somewhat extensive. Günther's account of *melinopterus* C. and V. (*loc. cit.*) fits my specimen almost exactly, whereas his account of *oligolepis* (*loc. cit.*, p. 449) does not.

M. nepalensis Gnthr. (*loc. cit.*, p. 424), of which I have seen no figure, and none but the original description, appears to be very closely related to, if not identical with, *oligolepis*.

There appears to be little of significance in Weber and de Beaufort's descriptions (*loc. cit.*) of *oligolepis* and of *melinopterus* to warrant their maintaining the two as distinct. In the length of the pectoral my specimen agrees with their account of *oligolepis*, whereas in the presence of the adipose eyelid it agrees with their *melinopterus*. It would appear that these two species are synonymous, or, at any rate, the specimens described by these authors are all of one species.

It may be noted that all descriptions of *oligolepis* that I have seen have been based on apparently juvenile specimens. A careful study of adequate material will probably show that *oligolepis* is merely the juvenile form of *melinopterus*.

SPECIES LIKELY TO BE DISCOVERED IN SOUTH AFRICA.

There are five species, widely distributed in the Indo-Pacific, which with more intensive collection will probably be found in our area. It seems desirable to indicate these, and to give a brief account of them and of their synonymy.

Those which occur in the Red Sea, or nearer our area, have been selected. Of these I have examined specimens of *caeruleomaculatus* Lacep. and of *speigleri* Blkr. only.

An abbreviated composite Key, to enable these species to be recognised, is appended.

The Fishes of the Family Mugilidae in South Africa. 639*Mugil tade* Forsk.

1861. Günther, Cat. Fish. B.M., vol. iii, p. 426 (*parsia* H-B), and p. 427 (*belanak* Blkr.), and p. 428 (*planiceps* C. and V.).

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 236.

1928. Fowler, Fishes Oceania, p. 122.

Adipose eyelids present. Maxilla exposed. Pectorals shorter than head without snout, with short axillary scale. Origin of first dorsal nearer snout tip than caudal base. Caudal feebly emarginate. D IV + I, 8-9, A III, 9, l.r. 33-35.

Distribution.—Indo-Pacific (Red Sea).

Mugil speigleri Blkr.

1861. Günther, *loc. cit.*, p. 435.

1888. Day, *loc. cit.*, p. 348.

1922. Weber and de Beaufort, *loc. cit.*, p. 241.

1928. Fowler, *loc. cit.*, p. 123.

Adipose eyelids present. Maxilla visible. Pectorals 1-1.15 in head, with long axillary scale. Scale at base of first dorsal as long as postorbital part of head. Origin of first dorsal nearer to snout tip than caudal base. Soft dorsal and anal densely scaled. Caudal forked. D IV + I, 8; A III, 9; l.r. 40-42.

Distribution.—Indo-Malayan area (Red Sea).

Mugil cunnesius C. and V.

1861. Günther, *loc. cit.*, p. 434.

1922. Weber and de Beaufort, *loc. cit.*, p. 242.

1928. Fowler, *loc. cit.*, p. 123.

Adipose eyelids present. Maxilla exposed. Pectorals shorter than head without snout, with long axillary scale. Origin of first dorsal nearer snout tip than caudal base. Soft dorsal and anal scaleless. D IV + I, 8; A III, 9; l.r. 42-43.

Distribution.—Indo-Malayan area (Red Sea).

Mugil labiosus C. and V.

1861. Günther, *loc. cit.*, p. 454.

1922. Weber and de Beaufort, *loc. cit.*, p. 259, fig. 67.

1928. Fowler, *loc. cit.*, p. 126.

Upper lip very thick, with a single series of papillae.

No adipose eyelids. Maxilla exposed (but stated to become hidden in large specimens?). Pectorals as long as head, with short axillary scale. First dorsal about midway between caudal base and snout tip. Caudal emarginate. D IV + I, 7-8; A III, 9-10; l.r. 34-36.

Distribution.—Indo-Malayan area (Red Sea).

Mugil caeruleomaculatus Lac.

1922. Weber and de Beaufort, *loc. cit.*, p. 250.

No adipose eyelids. Maxilla concealed. Pectorals 1.1 in head, with long axillary scale. First dorsal nearer snout tip than caudal base, or midway. Scale at base of first dorsal long, 1.8 in head, about as long as postorbital part of head. Caudal forked. No exposed area on chin. D IV + I, 8; A III, 9; l.r. 36-38.

Distribution.—Indo-Pacific (Zanzibar?).

ABBREVIATED COMPOSITE KEY.

- I. Adipose eyelids well developed, covering most of the iris posteriorly.
 - A. Scales 33-36.
 1. Pectorals longer than head without snout *strongylocephalus*.
 2. Pectorals not longer than head without snout *tade*.
 - B. Scales 38-43.
 1. Anal with 7-8 soft rays *cephalus*.
 2. Anal with 9 soft rays.
 - a. Maxilla concealed *robustus*.
 - b. Maxilla exposed.
 - i. Soft dorsal completely scaly *speigleri*.
 - ii. Soft dorsal not scaly *cunnesius*.
- II. Adipose eyelids small or rudimentary, covering not more than half of the posterior portion of the iris.
 - A. Upper lip very thick, almost half eye diameter at snout tip, with papillae on lower margin.
 1. Papillae in 5 or 6 series. Pectorals 1.3-1.4 in head. Scales 37-40 *crenilabis*.
 2. Papillae in one series. Pectorals 1-1.1 in head. Scales 34-36 *labiosus*.
 - B. Upper lip not more than $\frac{1}{3}$ eye deep at snout tip, without papillae.
 1. Dorsal scales multicanalicate. (Pectorals 1-1.1 in head) *canaliculatus*.
 2. Dorsal scales not multicanalicate.
 - a. Scales 41-49 (caudal forked).
 - i. Pectorals not longer than head without snout.

The Fishes of the Family Mugilidae in South Africa. 641

- x. Soft dorsal completely scaly . . . *euronotus*.
 - y. Soft dorsal not completely scaly . . . *capito*.
 - ii. Pectorals longer than head without snout.
 - x. Teeth tricuspid. Maxilla exposed *tricuspidens*.
 - y. Teeth not tricuspid. Maxilla concealed *seheli*.
- b. Scales 29-40 (caudal forked).
 - i. End of maxilla concealed.
 - x. Pectorals longer than head without snout.
 - a. Scale at base of first dorsal shorter than $\frac{3}{4}$ of post-orbital part of head.
 - * Scales 38-42 *seheli*.
 - ** Scales 33-36 *buchanani*.
 - β . Scale at base of first dorsal about as long as post-orbital part of head . . . *caeruleomaculatus*.
 - y. Pectorals not longer than head without snout *robustus*.
 - ii. End of maxilla exposed.
 - x. Ventrals longer than head without snout *compressus*.
 - y. Ventrals shorter than head without snout *macrolepis*.
- c. Scales 26-28.
 - i. Caudal almost truncate. Pectorals black *waigiensis*.
 - ii. Caudal emarginate. Pectorals light *oligolepis*.

HABITS, BREEDING HABITS, ETC.

The general habits of Mulletts are fairly well known, since these fishes live mainly inshore, on the surface and in shallow water. They are fairly easily captured and appear to thrive in aquaria.

In the latter may be seen how they project the mouth as a scoop and suck in sand or mud, triturate this for a time, and finally reject what has proved inedible.

Mulletts appear to be largely herbivorous, but will eagerly feed upon soft flesh, such as the liver or intestines of fishes, even of their own kind. They will also take insects which have fallen into the water. At Knysna I have observed a shoal feeding upon fallen flying ants which were over the water. Despite this, the species do not appear to take an artificial fly.

The intestinal contents nearly always consist very largely of sand. The intestine is very long, and the unabsorbed residue from the alimentary tract is little else but sand and shell particles. In the stomach itself, besides sand and mud, green algae, and fragments of marine plants, may occasionally also be found eggs, larval crustacea and fishes.

In tidal estuaries these fishes appear to congregate, especially at night, upon the sand- or mud-banks, where the mud and the eel-grass (*Zostera*) both teem with many lowly forms of life. From a boat I have watched shoals of small half-grown *Mugil* feeding. They swim in a compact body, facing the current, moving at the rate of a few inches a minute. They constantly suck up the mud, or the slime on the grass, retain it for perhaps 20 or 30 seconds, and eject the hard portion. The movements of such a shoal are extremely erratic. In the van are often to be seen a number of individuals who shoot forward some inches and then drop back into the main body. The shoal will veer as a whole to one side, or will move rapidly forward for a few feet and then resume the slow advance. Occasionally a shoal will be seen to break up, dart some distance back, and cover the same area at a slow pace.

These small shoals nearly always consist of individuals of more or less constant size. On one occasion only did I see a large specimen feeding with a shoal of others of very much inferior size. A lucky cast with a throw-net secured this specimen, which proved to be *cephalus*, while the others were *canaliculatus*.

I have never been fortunate enough to see a shoal of large specimens feeding in this manner. At night, with a powerful light, I have frequently been among large numbers of adults, but only occasional specimens came into the light; these were merely swimming idly and appeared uneasy, some sheering off wildly for no apparent reason, while others would swim until almost against the side of the boat before taking fright.

Mullets seem to be timid, but exceedingly curious. From a high rock, overlooking moderately deep water, I have dropped stones into the middle of a shoal. The fishes scatter widely, but almost immediately turn and circle in a dense cloud in the disturbed area. If a handful of crushed liver be thrown amongst them, the same performance results, and a fierce *mêlée* ensues until all has been consumed. Any sudden movement of an exposed part of the observer results in the rapid departure of the shoal, if the fishes be of any size.

"Harders" are generally captured by means of nets, but specialised

The Fishes of the Family Mugilidae in South Africa. 643

methods of angling are also employed with success. In tidal rivers very small hooks mounted on fine gut, buoyed with small corks and baited with dough, or with various fancy concoctions, are employed. In the sea at various places, liver or fish bait on tiny hooks is generally used. A large "Harder" or "Mullet," especially *tricuspidens*, provides magnificent sport on light tackle. Successful angling depends upon a close study of the habits of these fishes, and requires considerable skill and patience; this sport has not yet found favour with the majority of anglers in South Africa.

In the fresh waters of the Eastern Province "Springer" (*euronotus*) fishing is largely indulged in. To the line near the hook are fastened a number of small corks in a series, so as to keep 4 or 5 feet of the line on the surface. At the end, on some inches of fine gut, is mounted a small hook. The favourite lure is a "flying-ant." The fishes usually bite well towards evening, and large catches are frequently made.

In the Eastern Province the majority of the species appear to breed in September and October. The shoals come into shallow water all along the coast, and at night lie in the shallows, where the eggs are presumably shed and fertilised. At this time the fishes appear to be much less timid, and, by the aid of a light, may at night be scooped up in numbers with a landing net. I have in this fashion secured numbers in pools at the edge of the surf, both males and females, fully ripe. The females appear to outnumber the males by as much as ten to one.

It has frequently been stated that ripe fishes seek out tidal estuaries for the purpose of spawning. The evidence I have been able to obtain does not substantiate this belief, which is probably only partly correct. The fishes are certainly more plentiful in such waters at these times, but I have observed that they are also more numerous in the shallow water of the sea itself.

In estuaries, when every fish taken was ripe, I have at night, from a boat, with the aid of a light observed from two to four fishes slowly circling over shallow water on mud-banks. On some occasions, in still water, I have been able to keep them in the illuminated area for as long as ten minutes. On occasions there has appeared to be an ejection of faintly opalescent matter which instantly disappeared, but this has not been observed to be followed by the ejection of milt. I have several times captured, with a throw-net, two or three specimens so engaged, and on each occasion one of the fishes proved to be a ripe male, the remainder females, so it may be presumed that

they were engaged in spawning. It is, nevertheless, singular that tow-netting over these presumed spawning areas has in no case resulted in a catch containing eggs which could be shown to be those of ripe *Mugils*.

The somewhat oily flesh of the "Harder" is of fine texture and delicate flavour, and probably of relatively high calorific value.

These fishes are, especially in the Western Province of South Africa, highly esteemed, and a large "Harder," baked whole, is undoubtedly a culinary delicacy.

Vast numbers are caught annually, chiefly by drag-nets, whole shoals being encircled in the surf. On the west coast fair numbers are taken by floating gill-nets, anchored near the shore.

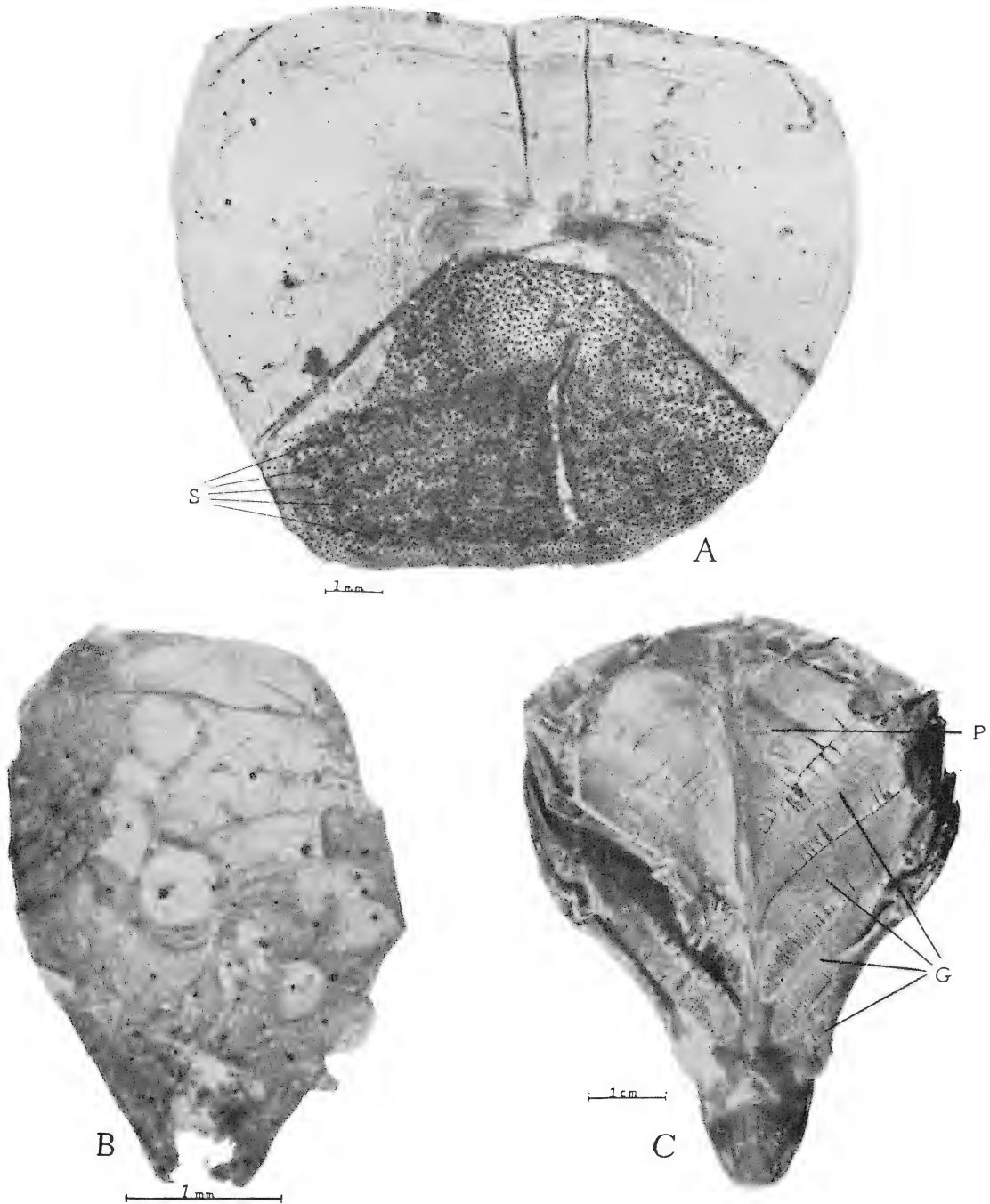
Large numbers are salted and dried, and these form an important part of the diet of the poorer section of the coastal population.

The flesh of those fishes taken far up in estuaries is generally slightly less palatable, while those taken from the inland waters of the Eastern Province have a distinctly unpleasant "muddy" flavour.

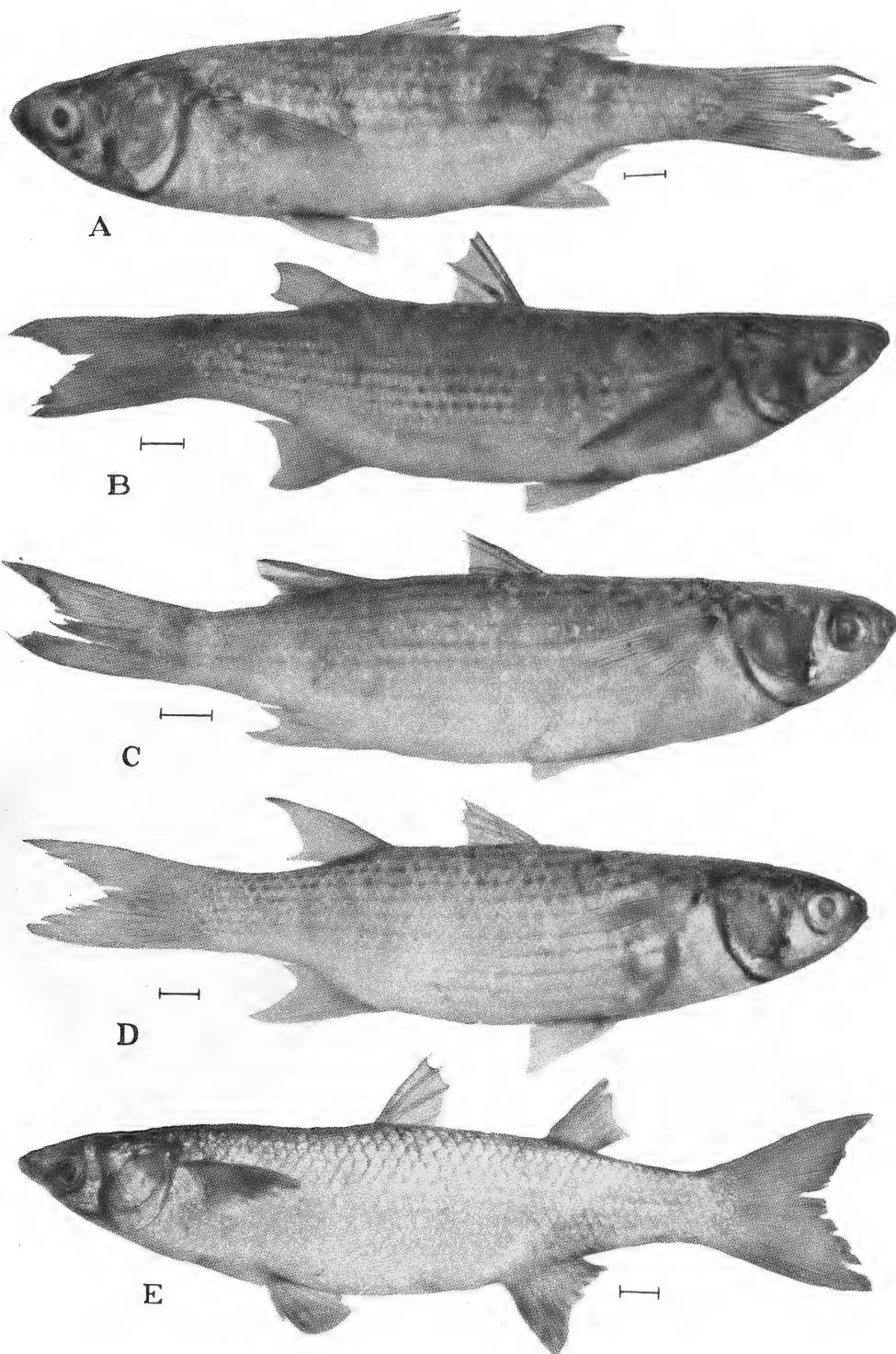
I wish to express my gratitude to the Director of the South African Museum for his kindness in assisting with the loan of the whole of the S.A. Museum collection of *Mugil* species, and of literature. To the Research Grant Board of South Africa (Carnegie Fund) for generous financial assistance, which has defrayed the greater part of the expenses incurred in the investigation. Also to Messrs. H. J. Koch and B. Hindson for valuable collections from Natal.

I must also acknowledge my indebtedness to Dr. C. von Bonde, Director of the Government Fisheries Survey, and to Mr. Bell-Marley, Principal Fisheries Officer of Natal, for permission to net in preserved waters.

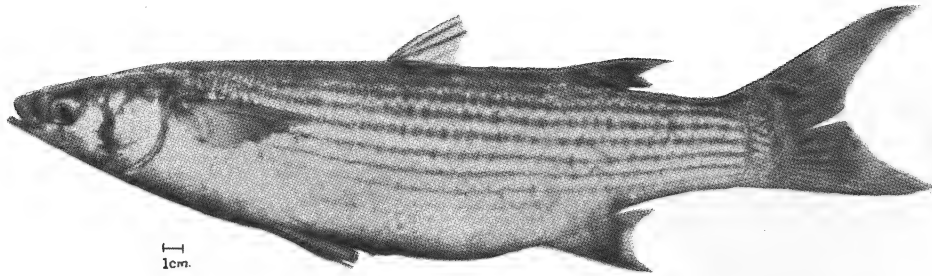
ALBANY MUSEUM,
GRAHAMSTOWN,
July 1934.



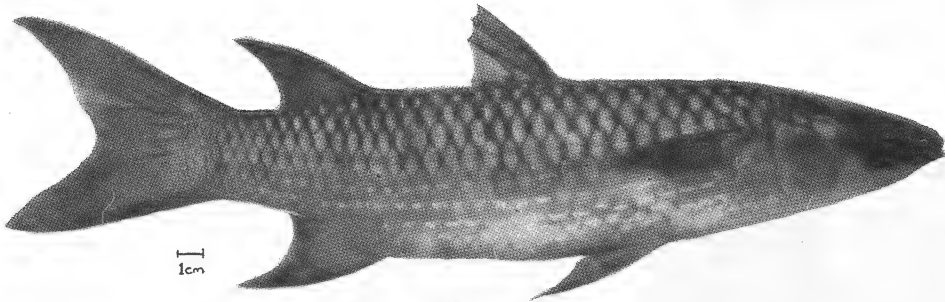
A, Latero-occipital scale of *Mugil cephalus* Linn., from specimen 405 mm. in length, to show secondary scaling. The lines radiating from S indicate rows of minute superimposed scales.
 B, A portion of the integument, from a medio-lateral scale of the same species (length 275 mm.), showing the small cycloid scales embedded therein.
 C, View of the branchial and lower pharyngeal regions of the same species (length 405 mm.). G, Rakers of the four branchial arches; P, Pharyngeal rakers.



Mugil species. A, *strongylocephalus* Rich.; B, *canaliculatus* n. sp.; C, *seheli* Forsk.; D, *buchanani* Blkr.; E, *euronotus* A. Smith. *The line below each figure represents 1 cm.



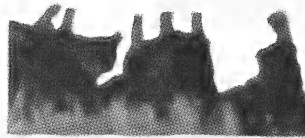
A



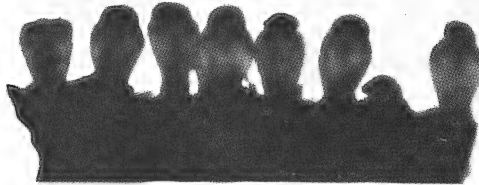
B



C



D



E



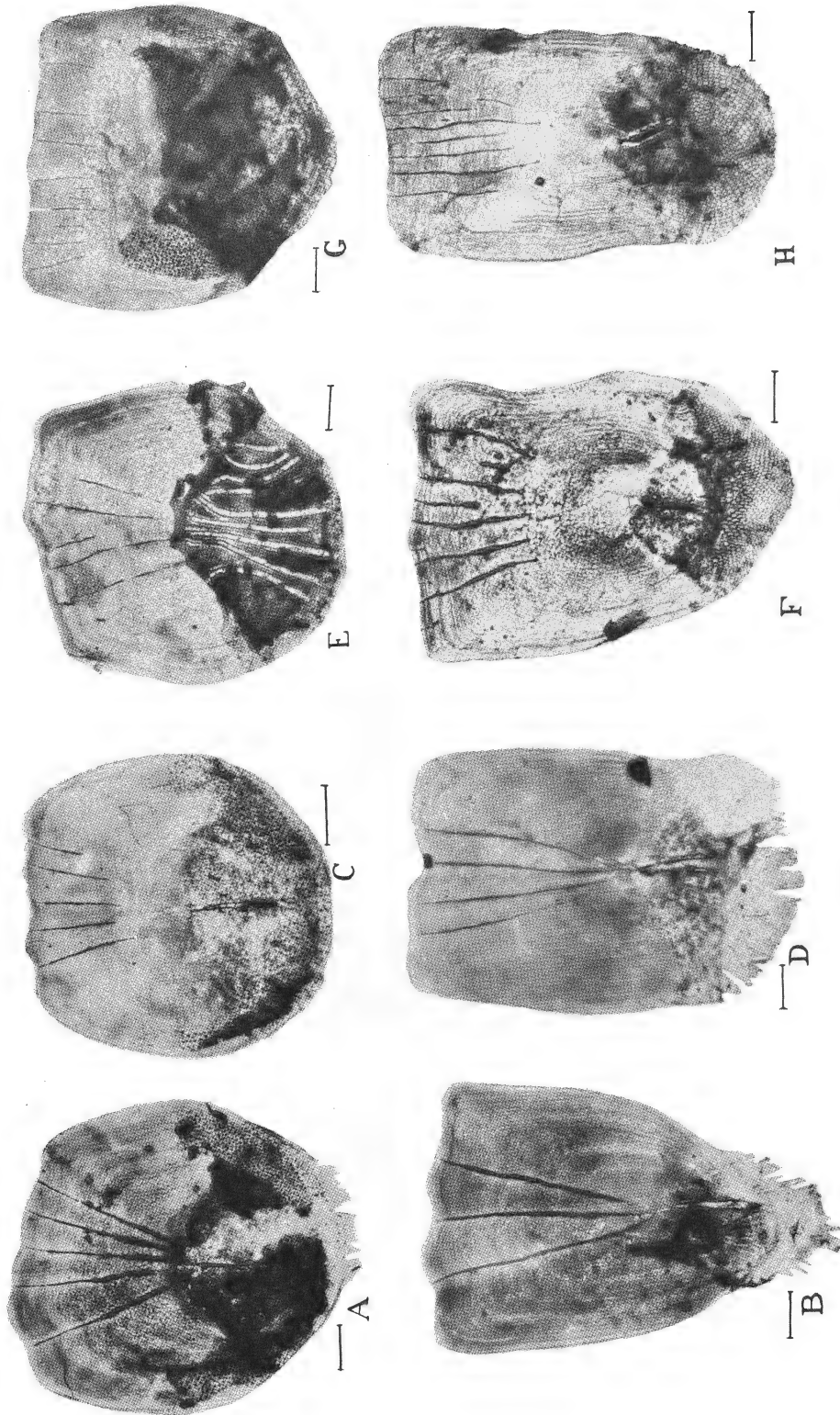
F



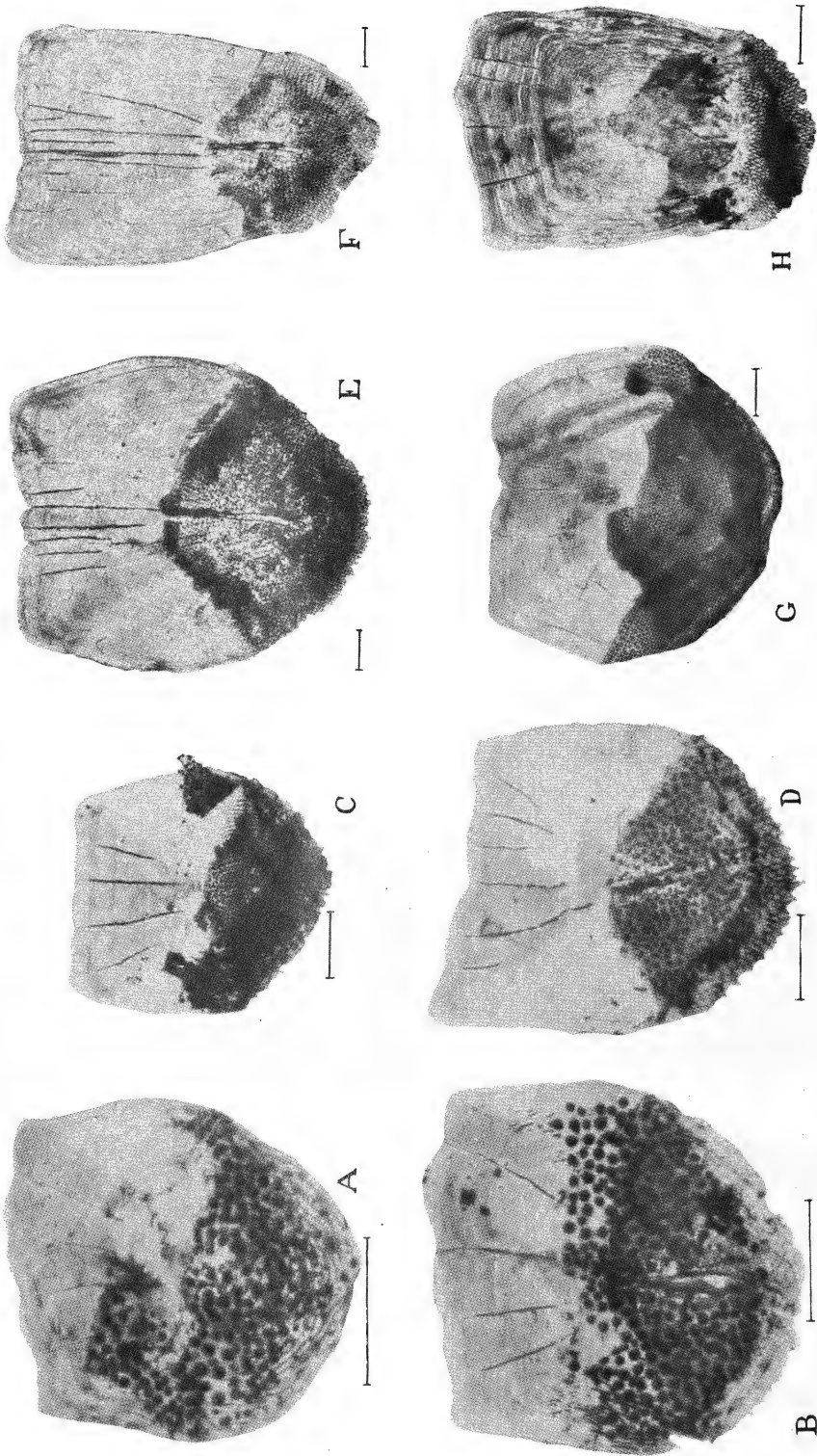
G

A, *Mugil tricuspidens*, n. sp.; B, * *Mugil compressus*, Gnthr.
C-G, premaxillary teeth of *Mugil* species. The total length of the specimens from which the teeth were taken is given in brackets. The line below each figure represents a tenth of a millimetre.
C, *capito* Cuv. (280 mm.); D, *canaliculatus* n. sp. (210 mm.); E, *euronotus* Smith (230 mm.); F, *tricuspidens* n. sp. (60 mm.); G, *tricuspidens* n. sp. (405 mm.).

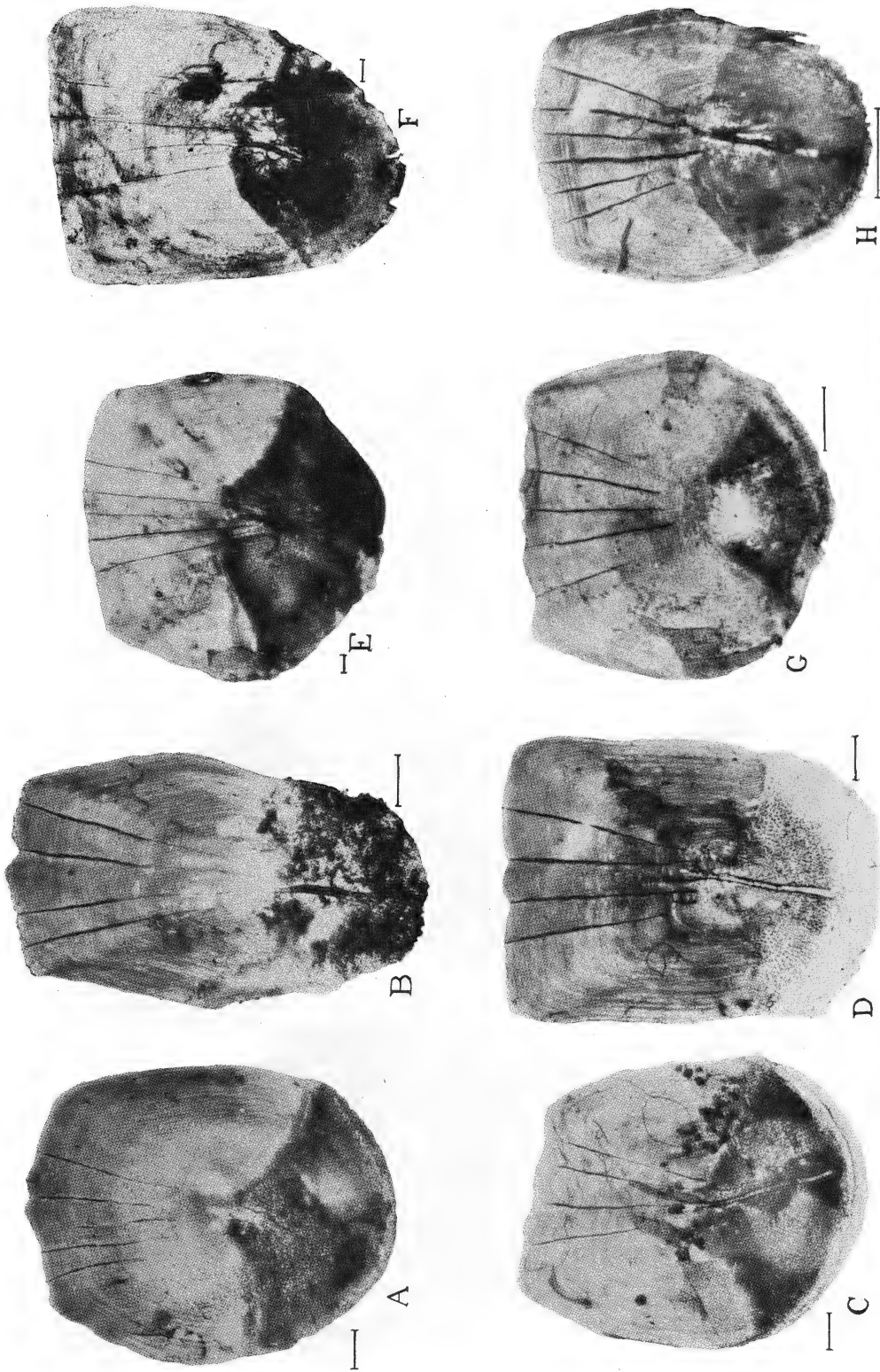
* Copied by permission, from a photograph taken by the Director of the Natal Museum.



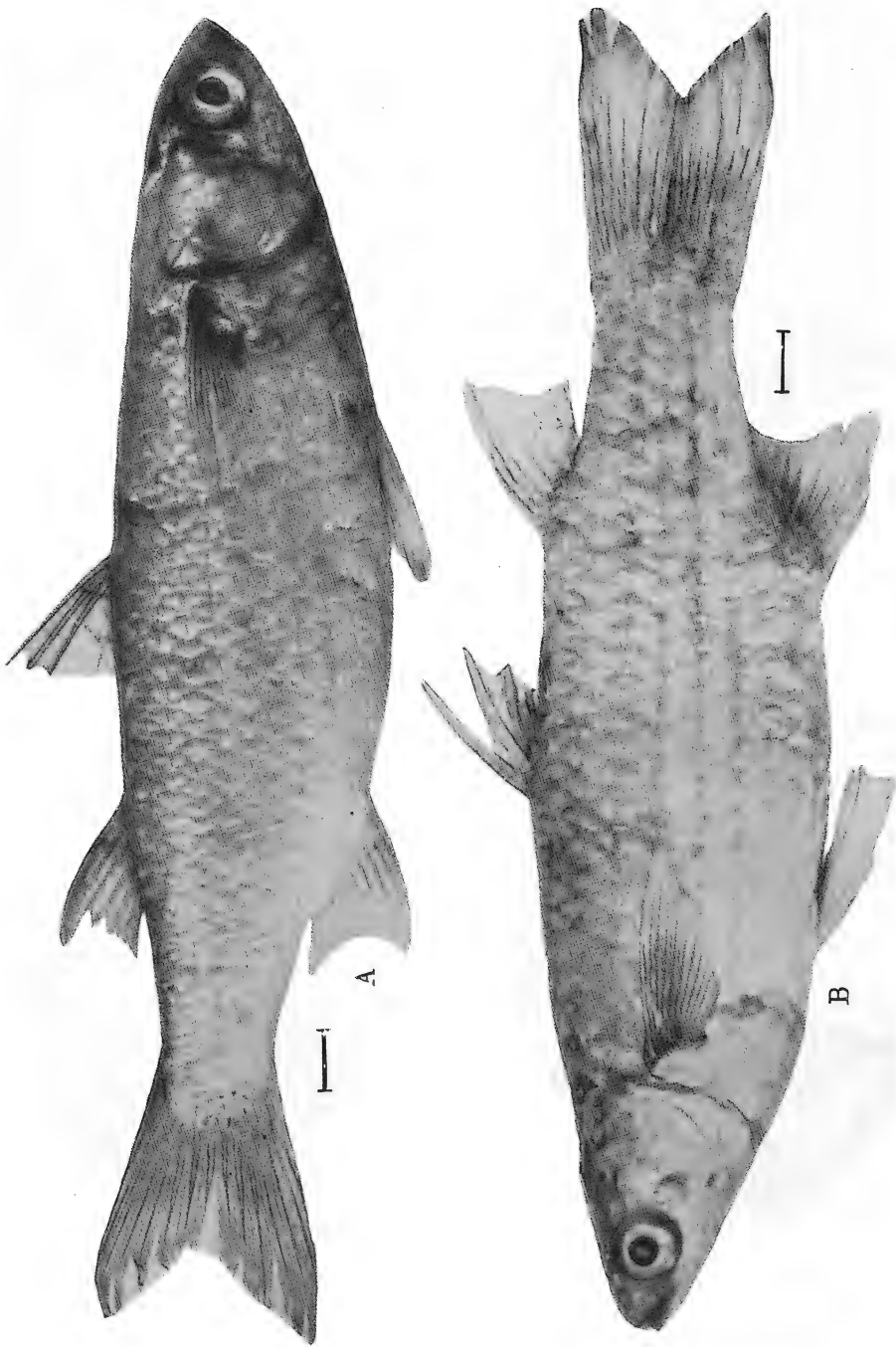
7th predorsal and mid-postventral scales of *Mugil* species. Predorsal scales are the first of each pair. The line below each scale represents 1 mm. The total length of the specimen from which the scale is taken is given in brackets. A and B, *strongylocephalus* Rich. (195 mm.); C and D, *sehelii* Forsk. (167 mm.); E and F, *canaliculatus* n. sp. (254 mm.); G and H, *tricuspidens* n. sp. (260 mm.).



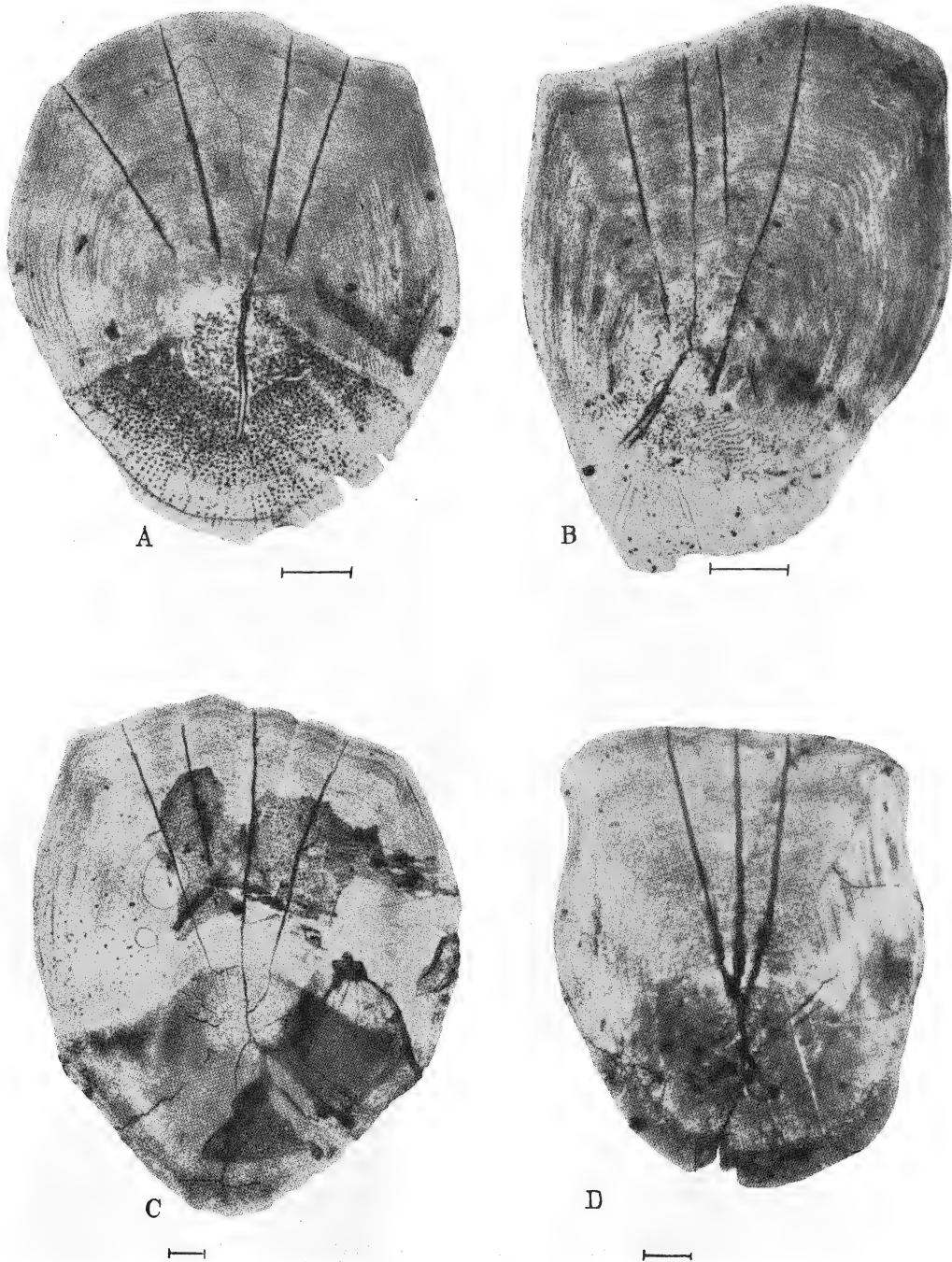
7th predorsal and mid-postventral scales of *Mugil* species. The total length of the specimen from which the scale is taken is given in brackets. The line below each scale represents 1 mm.
A-E inclusive, 7th predorsal scales of *capito* Cuv.: A (95 mm.), B (110 mm.), C (120 mm.), D (140 mm.), E (230 mm.); F, mid-postventral scale of *capito* Cuv. (230 mm.); G, 7th predorsal scale of *euronotus* Smith (225 mm.); H, mid-postventral scale of same.



7th predorsal and mid-postventral scales of *Mugil* species. The first of each pair is the predorsal scale. The line below each scale represents 1 mm. The total length of the specimen from which the scale is taken is given in brackets. A and B, *macrolepis* Smith (117 mm.); C and D, *buchananii* Blkr. (200 mm.); E and F, *compressus* Gnthr. (350 mm.); G and H, *waigiensis* Q. and G. (100 mm.).



A, *Mugil robustus* Gthr.; B, *Mugil oligolepis* Blkr.
The line below each figure represents 1 cm.



Scales of *Mugil* species.

A, 7th predorsal of *robustus* Gnthr. (200); B, mid-postventral of same; C, 7th predorsal of *oligolepis* Blkr. (206); D, mid-postventral of same.

The line below each figure represents 1 mm. The length of the specimen, in millimetres, from which the scales were taken, is given in brackets.

THE "GALJOEN" FISHES OF SOUTH AFRICA.

By J. L. B. SMITH.

(With Plates XIII–XVII.)

(Read May 15, 1935.)

FAMILY DICHISTIIDAE nov.

Body compressed, ovate or elevated. Mouth terminal, slightly protractile. Maxilla expanded distally, with large supero-median expansion (Pl. XVII, F); extremity not entirely covered by preorbital. No supramaxilla. Premaxillary pedicels moderate (Pl. XVII, G), not reaching frontals. A small pointed supero-median expansion on each premaxillary ramus, sliding behind maxilla. A single series of elongated compressed incisiform teeth in each jaw, with similar, but very much smaller teeth behind (Pl. XVII, C and G). Palate and tongue edentate.

Gill-membranes united forming a moderate fold across the throat, narrowly fused below with isthmus.

Two nostrils, close together.

Air bladder not constricted, nor posteriorly bifurcated.

Parietal crests very low: no transverse ridge at posterior margin of frontals. Supra-occipital fairly elevated, anterior edge thickened. A strong subocular shelf.

Vertebrae 25(10 + 15): precaudals with parapophyses from the fourth. Ribs, inserted behind and above level of parapophyses, sessile except last three.

Spinous dorsal of stout spines, shorter than soft fin. Anterior to the spinous dorsal several overlapping antrorse recumbent spines below the skin, the anterior (inferior) resting on the apex of the supraoccipital, the posterior ankylosed with the basipterygials of the first two exposed spines. Soft fins densely scaly, scaling not to margin.

Scales ctenoid, strongly adherent, deeply embedded.

The various taxonomic positions hitherto assigned to the genus *Dichistius* Gill would appear to have been selected in more or less arbitrary fashion. Regan (Ann. Mag. Nat. Hist., 1913 (8), vol. xii, p. 127) stated that it "probably pertained" to the **Girellidae**, in which family it was later placed by Barnard (Ann. S.A. Mus., 1927, vol. xxi, p. 635). Fowler (Proc. Ac. Nat. Sci. Phil., 1925, vol. lxxvii, p. 233) at first considered *Dichistius* to fall in the **Sparidae**; later (Bull. U.S. Nat. Mus., 1933, vol. xii, p. 216) in the **Kyphosidae**, while more recently (Proc. Ac. Nat. Sci. Phil., 1934, vol. lxxxvi, p. 476) for one of the species he has proposed a new genus placed in the **Scorpididae**.

A critical examination of the genus *Dichistius* has shown that there is

little to choose between these various diagnoses, since this genus appears to differ in about equal degree from the general diagnosis of each of those four families, showing perhaps least affinity with the **Girellidae**. It would, however, appear to differ from any one of the families **Kyphosidae**, **Sparidae** and **Scorpididae** by characters at least as significant as those which are generally accepted as justifying the separate existence of those three families.

The dentition, the exposed maxilla, and the nature of the vertebral column and appendiculars, among other features, would appear to rule out its inclusion in the **Girellidae**. The strong subocular shelf, and the nature of the vertebral column are not Kyphosid, while these features, together with the united gill-membranes, would scarcely allow of its inclusion in the **Scorpididae**. It is also well differentiated from the **Sparidae** by the relations of the maxillary bones alone.

Dichistius would actually appear to have closest affinity with the **Scorpididae**. In some respects, however, it would appear to be a connecting link between that family and the **Kyphosidae**, *e.g.* according to Regan (*loc. cit.*, p. 126) the **Scorpididae** all have 25(10+15) vertebrae, with parapophyses from the 3rd or 5th precaudals: the **Kyphosidae** (Regan, *loc. cit.*) have 24(10+14), with parapophyses from the 4th. *Dichistius* has 25 vertebrae, with parapophyses from the 4th. The dentition also is intermediate between that of the **Kyphosidae** and that of the **Scorpididae**, approximating, however, more closely to that of the former family.

From the skeletal and structural evidence I have obtained, it would appear as reasonable to unite the families **Scorpididae** and **Kyphosidae** as to place *Dichistius* in either. It is now proposed to regard *Dichistius* as the type of a separate family. It is frankly admitted that this diagnosis can at best be provisional only, since I have at my disposal only one genus, *Kyphosus* Lac. of the **KYPHOSIDAE**, and only *Neoscorpis* J. L. B. Smith of the **Scorpididae**. For further information in regard to skeletal features in those families I have relied upon Regan (*loc. cit.*). It may here be indicated that *Neoscorpis* differs from Regan's diagnosis (*loc. cit.*, p. 126) of the **Scorpididae** in that there is no subocular shelf. (I have examined a head of *Parascorpis* Blkr., and a strong subocular shelf is present.) Further, the hydrostatic organ is posteriorly bifurcated into two caudal extensions after the fashion of that of *Kyphosus* (that of *Parascorpis* does not, *fide* Dr. Barnard, *in litt.*). Nevertheless *Neoscorpis* agrees in the main with Regan's diagnosis of the **Scorpididae**, in which it undoubtedly falls.

It may be indicated that the nature of the obsolescent portion of the dorsal fin in Perciform fishes is a feature which has apparently not been assigned its true taxonomic significance, and which may assist in elucidating hitherto obscure relationships.

In *Kyphosus* there are 11 exposed dorsal spines. Anterior to and quite separate from these, below the skin, is the rudiment of a single-spined, probably separate, dorsal, the spine being so far obsolete that it cannot be determined whether it was originally antrorse or retrorse. In *Neoscorpis* there is evidence of the existence at some period of two separate spinous dorsals, of which the first was composed of three spines, the anterior of which was antrorse and procumbent, the middle spine either antrorse or retrorse, while the posterior spine was likely normal and retrorsely depressible. The posterior spinous dorsal of *Neoscorpis* is also evidently undergoing reduction. That fin would appear at some stage to have consisted of 10 exposed spines, proportioned much as the 10-spined fin of *Dichistius*. From 2 to 4 of the anterior spines have already become obsolete, and reduced to subcutaneous dilations of the basipterygial apices. In some specimens the anterior exposed spine is so minute that its presence may be ascertained only upon dissection.

In *Dichistius*, immediately anterior and adjacent to the exposed 10-spined dorsal, is a subcutaneous structure of four overlapping antrorse procumbent spines, of which the posterior (and superior) is fused with the united basipterygials of the first two external spines (Pl. XVII, B), while the anterior rests upon and over the supraoccipital apex. It may be noted that an exactly similar structure is present in *Platax* Cuv., *Drepane* Cuv., and *Tripteron* Plyfr. *Dichistius* is related to this group of allied genera in other ways, and in some respects falls intermediate between these genera and the natural group of the **Scorpididae**, **Kyphosidae** and **Sparidae**.

The species of the single genus of the **Dichistiidae** are confined to the southern African region, and are found only in shallow water.

Genus DICHISTIUS Gill.

- 1888. Gill, Proc. U.S. Nat. Mus., vol. ii, p. 68. (Type *capensis* Cuv. *Dichistius* proposed to replace *Dipterodon* Cuv., preocc.)
- 1927. Barnard, *loc. cit.*, p. 635. (*Dipterodon* Cuv.)
- 1933. Fowler, Bull. U.S.N. Mus., vol. xii, p. 215. (*Coracinus* Gron.)
- 1934. Fowler, Proc. Ac. Nat. Sci. Phil., 1934, vol. lxxxvi, p. 476. (*Drepanoscorpis*.)

Body compressed, elevated or ovate. Mouth terminal, slightly oblique, protractile. Maxilla not completely covered by preorbital. Posterior teeth in each jaw incisiform, very small, in two rows, inserted on roof and floor of mouth well behind the exterior incisors. Pharyngeal teeth enlarged, obtuse, molariform (Pl. XVII, D and E).

Gill-rakers moderate in size and number. Branchiostegals 7, basal membrane scaly. Gill-membranes scaly, united, forming a fold across the throat, narrowly united with isthmus.

Two nostrils, close together, the anterior much the larger, each with a plain flap. Preorbital of moderate and uniform depth, lower margin entire, posterior portion scaly. Preopercle margin serrate (Pl. XVII, A).

Dorsal with deep scaly sheath, of 10 stout spines, the middle the highest, deeply

notched between spinous and soft portions. Soft dorsal longer than spinous, anterior rays forming a prominent lobe, sometimes sub-falcate. Soft fin densely scaly for at least the basal half. Anal of three spines, first short and stout, remaining two subequal in length. Soft anal of 13 to 14 rays, the anterior elevated forming a lobe. Scaly as for dorsal. Ventrals inserted well behind pectorals, of moderate size, slightly shorter than pectorals. Caudal slightly forked. All fins scaly.

Scales firmly adherent, small, ctenoid, lateral line tubular scales much smaller than adjacent scales.

The original generic name was *Coracinus* Gron. [*cauda lunata* Gron., 1763].

According to Mr. Norman of the British Museum, by Opinion 89 of the International Commission, Gronovius is ruled out, unless his name can be shown to have been adopted by some later accepted binomial author. There appears to be no record of any such usage between 1763 and 1888, when Gill (*loc. cit.*) proposed *Dichistius*. In view of the generally accepted Rules and Opinions of the International Commission, therefore, it appears that *Dichistius* Gill must replace *Coracinus* and *Dipterodon*.

Fowler's *Drepanoscorpis* (*loc. cit.*) is somewhat difficult to understand. His description of the species *Drepanoscorpis gilchristi* agrees in all particulars with his own earlier descriptions of *Dipterodon capensis* C. and V., and of *Coracinus capensis* C. and V. It is possible that Fowler recognised *gilchristi* as being identical with those specimens earlier described as *capensis*, but he makes no mention of this. There is no room for doubt that *gilchristi* Fowler is identical with the species *multifasciatus* Pell. (see below). Since that species and *capensis* are emphatically congeneric, Fowler's genus falls into the synonymy of *Dichistius*.

The original species of this genus must have been one of the earliest typical Cape fishes to be recognised by the early settlers, as it is fairly abundant in shallow water. Only one species was recognised until Pellegrin (Bull. Soc. Zool. Fran., 1914, vol. xxxix, p. 231) described *multifasciatus* (type locality Madagascar) and distinguished it from the common Cape *capensis* C. and V. This diagnosis has not been accepted by subsequent workers, partly because Pellegrin laid stress upon certain features which can hardly ever be of much taxonomic significance. Nevertheless as is shown below, *multifasciatus* is a perfectly valid species, being clearly differentiated from *capensis* by numerous features.

Examination of material from all parts of the South African coast has revealed that a third species, *falcatus* n. sp., is also present. This may immediately be distinguished from the other two species by its general outline, but it has proved exceedingly difficult to reduce the differentiation to an immediately appreciable quantitative form. This species is exceedingly close to *capensis*, and may even be regarded as merely a sub-species.

Since trinomialism does not yet appear to be generally accepted ichthyological practice, *falcatus* is here described as a distinct species.

The following table indicates some of the features in which differentiation between the three species is found.

	<i>capensis.</i>	<i>falcatus.</i>	<i>multifasciatus.</i>
Depth peduncle in body depth . .	3.1-3.2	3.0-3.2	3.9-4.1
Pectorals in body length . . .	4.0-4.1	3.6-3.8	3.5-3.8
Ventrals in body length . . .	4.5-5.0	4.0-4.5	3.7-4.0
Preorbital depth in head . . .	6.5-7.2	6.0-6.6	5.3-5.6
Base of soft dorsal with length of head	Less than.	Less than.	Greater than.
Lateral rows of scales . . .	75-78	73-78	83-86
Dorsal profile curve . . .	Broken at eye.	Smooth.	Smooth.
Anterior dorsal rays . . .	Not falcate.	Falcate.	Not falcate.

Besides these features, there are numerous others, which are indicated below in the descriptions. The distribution of the three species is of interest: *capensis* appears to occur from the Cape to about East London, *falcatus* n. sp. from about Knysna to Natal, and *multifasciatus* from about Algoa Bay to Madagascar.

Key to the Species.

- I. Least depth of peduncle 3.0-3.2 in body depth.
 - Body more than twice as long as deep. Cross bars, if present, of uniform width.
 - A. Pectorals 4.0-4.1 in length of body. Anterior dorsal rays not falcate *capensis.*
 - B. Pectorals 3.6-3.8 in length of body. Anterior dorsal rays falcate *falcatus.*
- II. Least depth of peduncle 3.9-4.1 in depth of body.
 - Body less than twice as long as deep. Cross bars alternately wide and narrow *multifasciatus.*

The length of the pectoral is measured from the body to the tip of the fin when the latter is held at right angles from the side.

Dichistius capensis (C. and V.).

(Plate XIII.)

1831. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. vii, p. 276, Pl. 188.
1908. Gilchrist and Thompson, Ann. S.A. Mus., vol. vi, p. 165. (*Dipterodon capensis* C. and V.)
1914. Gilchrist, Mar. Bio. Rep., vol. ii, p. 90. (*Dipterodon capensis.*)
1927. Barnard, Ann. S.A. Mus., vol. xxi, p. 635. (*Dipterodon capensis*, part), Pl. 25, fig. 2.

Body ovate, compressed but robust, maximum width 1.6–1.7 in head. Dorsal profile gently sloping to interorbital, steeper to snout tip. Snout distinctly blunt, almost vertical from prominent interorbital in some specimens.

Depth 2.2, length of head 3.2–3.3 in length of body. Eye 3.8 (Juv.)–4.5, snout 3.0–3.1, interorbital 2.5–2.6, postorbital part of head 1.7–1.8 in length of head. Preorbital uniformly deep, depth above end of maxilla 6.4–7.2 in head. The distance from the upper margin of the dorsal sheath at base of 4th dorsal spine to the nearest point of the lateral line distinctly less than post-orbital part of head.

Mouth moderate, terminal, slightly oblique, maxilla extends to below or almost below anterior border of orbit: in small specimens below anterior part of eye. Distance from hind margin of maxilla to upper margin of upper lip at snout tip 2.1 in postorbital part of head. Upper lip deep and fleshy, depth at snout apex 2 in eye. 20–26 compressed elongate incisiform teeth in upper jaw, 20–24 similar in lower jaw. Two rows of about 8 each of similar smaller teeth, concealed in fleshy pads, behind the outer series in each jaw. Palate and tongue edentate.

Gill-membranes united, forming a smooth fold across the throat, fused anteriorly below with isthmus. Gill-rakers moderate, 5–6+13–15, 1.8–2 in gill-filaments, which are 1.0–1.3 in eye.

D X, 18–19, inserted above midway between pectoral and ventral origins or slightly nearer the pectoral, deeply notched between spinous and soft portions. Spines fairly stout. First spine 10–14, 2nd 4–6, 3rd 2.5–3.3, 4th and 5th 2.2 in length of head, thereafter graduated shorter. Soft rays anteriorly elevated forming a blunted or pointed lobe, not falcate. Lobe extends beyond tip of tenth dorsal spine 1.7–2.1 in head, equal to or less than postorbital part of head. Base of soft dorsal shorter than head.

A III, 13–14, inserted below the origin of the soft dorsal. Spines stout, first 5.9–6.6, second 4–4.5, third 4.5–4.8 in length of head. Soft rays anteriorly elevated forming a broad lobe, which extends 1.9–2.2 in head beyond the apex of the third anal spine.

Pectorals 4.0–4.1 in length of body, tip reaches below more than an eye diameter short of the origin of the soft dorsal.

Ventrals 4.5–5.0 in length of body, tip does not reach origin of anal; in large specimens the tip does not reach beyond the vent.

Caudal moderately forked, peduncle 1.1–1.2 times as long as deep. Least depth of peduncle 3.1–3.2 in depth, 6.7–7.0 in length of body.

Scales ctenoid, larger on posterior part of body, all deeply embedded. Lateral line gently curved, tubular scales smaller than adjacent scales. Lateral rows 73–78, tubular scales 60–64; 28–30 above lateral line obliquely back from base of first dorsal spine. Whole body and head, except muzzle, scaly. Median fins scaly; on soft dorsal and anal scaling extends about half length of rays and is not very dense beyond the basal third. Bases of alternate dorsal spines scaly. Pectorals and ventrals scaly about three-fourths.

Colour.—Rather variable when taken from the water; either bright silvery, or with light or dark irregular blotches, or wholly dark. Uniform or with 7–9 uniformly wide cross bars, wider than the interspaces. Dorsal spines, dorsal and anal lobes, and ventral rays black or dusky. After death the colour is usually uniform dusky or almost black, with or without cross bars.

Locality.—Walfish Bay to Table Bay (Gilchrist); Cape Peninsula to Port Alfred, very occasionally entering tidal rivers, then rarely beyond the reach of the waves.

Length.—Up to 600 mm.

Eight specimens from 140 mm. up examined.

D. capensis is the well-known "Galjoen" (*Ang. Galleon*) of the Cape.

It is a somewhat polymorphous species, and sub-species will most likely eventually be proposed. It may immediately be distinguished from *multifasciatus* by the shallower body, by the heavier peduncle, and by the body markings, besides other features: from *falcatus* by the markedly shorter fins, as well as by the characteristic snub nose.

The colouration of the live fish is extremely variable, even in specimens from one restricted area. The live fish may be uniform, or blotchy, or mottled in various shades of silver to black. Cross bars are rarely observed on the live fish in the summer months, generally appearing, if at all, when the fish is moribund. The banded form is commoner eastwards from Knysna, and is more frequently observed during the winter months. When the fish is moribund the melanophores evidently expand fully, for whatever the colour of the live fish, soon after death it is almost black. It is possible that there is a nocturnal barred colour phase, such as I have observed in the species at present recognised as *Sparus sarba* Forsk, but as the "Galjoen" does not appear to feed during the night, information on this point is not available. Gilchrist (*loc. cit.*), who studied the colour phases of this species in an aquarium, is rather vague about the banded phase, and does not appear to have examined the specimens at night.

Gilchrist had in the aquarium noticed the great ease with which this species could turn and reverse its progress. These fishes must be extremely powerful, for they evidently swim freely even in turbulent surf. The general habits and environment of this species have frequently been outlined, and detailed repetition is unnecessary, but one or two characteristics call for special mention. From a rocky ledge overlooking moderately deep water at the edge of a reef, I have been able to attract several of this species by dropping into the water pieces of "Red-bait" (an Ascidian: *Pyura stolonifera*). These the fishes would seize right in the surface of the water. After some time, the bait was thrown on to the reef itself, and after several times seizing bait which had been swept back by the receding wave, on several occasions one of these fishes actually came over the reef in the surge of the wave in pursuit of a piece of bait, seized this, and returned to deeper water before the wave had subsided.

That this species will perform a feat of this nature is evidently well known. One angler has reported having seen one of these fishes actually left stranded on an isolated rock by one wave, and returning to the water by the next. Another who had noticed these fishes passing over a rock in the surges of the waves states that he actually hooked a fish by casting his bait on to the rock itself. In the Eastern Province of South Africa this species is frequently taken by anglers in the surf at high tide, being often actually hooked on a spot which at low tide would be above the level of the water. From this characteristic has resulted the Eastern Province

name of "Highwater." It has been observed that when this species is hooked in relatively shallow water over broken rocky ground, it will occasionally jump clear of the water, more often than not thereby freeing itself from the hook.

This species appears to feed very largely upon the common mussel (*Mytilus edulis*), the intestinal residues generally consisting chiefly of crushed mussel shells. The stout anterior teeth of the "Galjoen" are admirably adapted for wrenching or twisting shellfish from the rocks, and these mollusca are doubtless crushed between the pharyngeals, which bear heavy crushing molariform teeth (Pl. XVII, D and E). Seaweeds also at times form a large part of the diet of this species.

Ordinary "Red-bait" is the common bait employed on lines, but large specimens have also been taken on fish bait, as well as on "Sea-cat" (*Polypus* sp.).

It may be noted that in areas much frequented by anglers this species has diminished most markedly in numbers within the last thirty or forty years, so that where large catches were at one time of common occurrence, the capture of even a single specimen may now be an event. On the other hand, in places difficult of access and so rarely fished, it is still possible to catch large numbers of these fishes at any normal time. There is every indication that this species moves within a comparatively restricted area, so that intensive fishing may well produce a local scarcity.

The spawning habits of this species are unknown. It is curious that the specimens examined have all been immature males. It might be suggested that anglers in the Western Province should examine fishes caught in the winter months and forward specimens of ripe females to the South African Museum.

Dichistius falcatus n. sp.

(Plates XIV and XVII.)

Body ovate, fairly compressed, maximum width 1.6 in head. Dorsal profile gently curved, interorbital prominence very slight, snout little steeper below.

Depth 2.0-2.1, length of head 3.0-3.3 in length of body. Eye 4.3-5.0, snout 3.0-3.3, interorbital 2.5, postorbital part of head 1.7-1.8 in length of head. Preorbital uniformly deep, depth above end of maxilla 6.0-6.6 in head. The distance from the upper margin of the sheath at the base of the fourth dorsal spine to the nearest point of the lateral line is equal to or less than the postorbital part of the head.

Mouth terminal or even occasionally sub-inferior, slightly oblique, maxilla extends to below anterior border to first third of eye, extremity not covered. Distance from hind margin of maxilla to upper margin of upper lip at snout tip 1.7-1.9 in postorbital part of head. Upper lip deep and fleshy, depth at snout apex 1.8-2 in eye. 20-24 compressed rather elongate incisiform teeth in a single row in each jaw, anterior subtruncate, lateral

teeth more acute. Two series of about eight each of similar but much smaller teeth behind the outer series in each jaw, concealed in fleshy pads. Palate and tongue edentate.

Gill-membranes united forming a fold across the throat, narrowly united below with isthmus. Gill-rakers 5-6+13-14, 2-2.5 in gill-filaments, which are 1-1.1 in eye.

D X, 19-20, inserted above slightly nearer pectoral than ventral base, deeply notched. Spines fairly stout, heteracanth, fold into deep scaly sheath. First spine 10-12, 2nd 4.3-4.5, 3rd 2.5-2.6, 4th 2.1-2.2, 5th 2.0-2.1 in head, thereafter shorter to the 9th. Soft rays anteriorly elevated, falcate or subfalcate, edge of fin deeply concave. The tip of the lobe when depressed usually reaches above beyond the apex of the depressed last anal ray, and extends beyond the apex of the 10th dorsal spine 1.5-1.7 in head, usually longer than postorbital part of head. Base of soft dorsal shorter than head.

A III, 13-14, inserted below slightly before origin of soft dorsal, spines moderately stout, first 5.5-6, 2nd 3.3-3.5, 3rd 4.0-4.3 in head. Soft rays anteriorly elevated forming a subfalcate lobe, which extends 1.6-1.7 in head beyond the apex of the 3rd anal spine, edge of fin deeply concave. Base of soft anal 3 in depth of body.

Pectorals 3.6-3.8 in length of body, tip reaches almost below origin of soft dorsal.

Ventrals 4.0-4.5 in length of body, apex reaches, or almost reaches, base of first anal spine.

Caudal moderately forked, peduncle 1.1-1.2 times as long as deep. Least depth of peduncle 3.0-3.2 in depth of body, 6.6 in length of body.

Scales ctenoid, somewhat larger on posterior part of body, generally larger below lateral line than above. Lateral line gently curved, lateral rows 73-78, tubules about 65, 28-30 above lateral line obliquely back from base of first dorsal spine. About 50-60 predorsal, and about 25-30 on cheek to preopercle edge. Whole body and head, except muzzle, scaly. Median fins densely scaly, on soft dorsal and anal posteriorly scaling scarcely extends more than half length of membrane. Scaly sheath of spinous dorsal continued along basal portion of alternate spines. Pectorals scaly three-fourths. Ventrals with outer rays only scaly.

Colour.—Dark brown to black with or without 8-10 darker cross bars about equal to eye, wider than interspace, first over nape, last on peduncle. Fins black, caudal dusky. Iris bronzy.

Length.—Up to 400 mm.

Locality.—Knysna, Port Alfred, Great Fish Point, Cove Rock (East London), Transkei Coast.

Type from Great Fish Point (Pl. XIV) in the Albany Museum. Seven specimens from 200 mm. up examined.

This species is admittedly very close to *capensis* and was separated only after long and detailed study. It is possible that specimens may ultimately be obtained which will show complete transition between the two forms here recognised.

Nevertheless the form of *falcatus* is characteristic of the coast of the south-eastern Cape, and after brief study there is no difficulty in distinguishing it from *capensis*. All the fins are markedly longer, even the spinous dorsal, the mouth is slightly larger, and always extends to the eye, while the shape of the snout is characteristic, being more rounded. Further, this species is more often taken with cross bars than *capensis*, and the silvery colour phase occasionally found in that species is apparently very un-

common, or unknown, in *falcatus*, most specimens being very dark in colour.

It appeared at one time as if sexual dimorphism might account for the difference between *capensis* and *falcatus*, since all my specimens of the former appeared to be males, and most of the latter, with the exception of one or two too immature or decomposed for positive determination, females. Nevertheless, this hypothesis is scarcely tenable, since to my knowledge the form of *falcatus* does not occur near the Cape Peninsula, while *capensis* grows to a larger size than that species, which would be remarkable if *capensis* proved to be the typical form of the male.

The habits and environment of *falcatus* are very similar to those of *capensis*, except that the former appears to prefer less turbulent water, being generally taken from deeper water in gullies or on reefs. The chief food appears to be the common mussel, together with occasional small crustacea and seaweeds.

In some respects *falcatus* appears to fall midway between *capensis* and *multifasciatus*, and has probably contributed to the non-recognition of the latter. It is well differentiated from *multifasciatus* as very brief study shows.

Ripe females of *falcatus* are taken on the coast of the Eastern Province chiefly during August. The eggs are pelagic, very numerous, and less than 1 mm. in diameter.

Dichistius multifasciatus (Pell.).

(Plates XV and XVI.)

"Kolayeletye"; "Ntombiyeeletye." (Native names.)

1914. Pellegrin, Bull. Soc. Zool. Fr., vol. xxxix, p. 231.

1925. Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxvii, p. 233. (*Dipterodon capensis* C. and V.)

1927. Barnard, loc. cit., p. 635. (*Dipterodon capensis* C. and V., part.)

1933. Fowler, Bull. U.S. Nat. Mus., vol. xii, p. 216. (*Coracinus capensis* C. and V.)

1934. Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxxvi, p. 476, fig. xlii. (*Drepanoscorpis gilchristi*.)

Body deep, margins subangular, very compressed, maximum width 1.8-2.0 in head, 3.0-3.3 in depth of body. Dorsal profile of snout fairly steep, in a more or less even curve from first dorsal, with very slight interorbital prominence.

Depth 1.8-1.9, length of head 3.0-3.2 in length of body. Eye 4.0-4.3, snout 2.8-3.0, interorbital 3.1, postorbital part of head 1.8-1.9 in length of head. Preorbital uniformly deep, depth above end of maxilla 5.3-5.6 in head. The distance from the upper margin of the sheath at the base of the fourth dorsal spine to the nearest point of the lateral line is 1.15-1.2 times the postorbital part of the head.

Mouth moderate, terminal, slightly oblique, maxilla extends to below nostrils or to below anterior part of orbit, extremity not covered. Upper lip rather deep and fleshy,

depth at snout apex 2.3-2.5 in eye. 30-34 elongate teeth in single outer series in upper jaw, anterior more or less truncated, posterior more slender and acute. Two series of similar but much smaller teeth behind the outer, concealed in fleshy pads, and very fragile. Similar teeth in lower jaw. Palate and tongue edentate.

Gill-membranes united forming a moderate fold across the throat, narrowly united with isthmus below. Gill-rakers moderate, 5-6 + 14-15, 1.8-2.2 in gill-filaments, which are 1.2-1.3 in eye.

D X, 21-23, inserted above nearer base of pectoral than base of ventral, deeply notched between spinous and soft portions. Spines stout, heteracanth, fold into deep scaly sheath. First spine 10-15, 2nd 4.5-6, 3rd 2.6-3.2, 4th 2.2-2.5, 5th 2.2-2.4 in head, thereafter graduated shorter. Soft rays anteriorly elevated forming a short blunted or pointed lobe not falcate, which extends beyond apex of 10th spine much less than length of postorbital part of head. Base of soft dorsal longer than (1.1-1.2 times) head. The tip of the depressed anterior rays scarcely reaches beyond the base of the last anal ray.

A III, 13-14, inserted below the origin of the soft dorsal. Spines stout, first 5.6-6.0, 2nd 3.3-3.5, 3rd 4.0 in head. Soft rays anteriorly elevated, slightly longer than dorsal rays. Lobe extends 1.9-2.1 in head beyond apex of last anal spine. Edge of fin deeply concave. Base of anal 2.7-3 in depth of body, greater than postorbital.

Pectoral 3.5-3.8 in length of body.

Ventrals 3.7-4.0 in length of body, apex usually reaches well beyond the base of the first anal spine.

Caudal moderately forked, peduncle 1.2-1.3 times as long as deep. Least depth of peduncle 3.9-4.1 in depth of body, 7.4-7.6 in length of body.

Scales ctenoid (Pl. IV, A) somewhat larger on posterior part of body. Lateral line scales largely concealed, smaller than adjoining scales, tubes simple (Pl. IV, B). Lateral line gently curved. Lateral rows 83-86; tubules about 70, but almost impossible to count with accuracy; 28-31 above lateral line, counted backwards from base of first dorsal spine. About 50-55 predorsal, and about 20 on cheek to edge of preopercle. Whole body and head scaly, except snout in advance of nostrils, anterior part of preorbitals, and chin. Median fins densely scaled. On soft dorsal and anal scaling extends at least $\frac{3}{4}$ of length of membrane, even of posterior rays, and is very dense. Pectorals scaly for proximal three-fourths. Ventrals similarly between outer rays. Bases of alternate dorsal spines scaly.

Colour.—Light silvery brown, with seven darker cross bands about equal to light interspace, equal to or wider than eye; between each pair a much narrower stripe. First bar over nape, last over peduncle. Head dark. Membrane of spinous dorsal black, hinder margin lighter. Hind margin of caudal black. Anal spines light, soft fin dark. Ventral spine light, distal $\frac{3}{4}$ of fin dark. Pectoral dark distally. Iris bronzy.

Length.—Up to 285 mm.

Locality.—Knysna (Juvenile 55 mm.); Great Fish Point; East London to Durban; Madagascar (Type locality).

The body shape of this species is characteristic (Pl. XV), and enables it to be identified at a glance even in preserved or dried specimens from which all trace of marking has faded. The heavy scaly investment of the median fins prevents much movement of the rays, and in those specimens I have examined the dorsal and anal rays have remained fully erect.

This is a much more uniform species than *capensis*, and in so far as I am aware, unbanded specimens are never encountered. The alternate

wide and narrow bands are very characteristic, and very vivid in the live fish, or in fresh specimens.

There can be no question of the validity of *multifasciatus*, and it is remarkable that subsequent workers should have rejected Pellegrin's perfectly plain diagnosis of the differentiation from *capensis*. The very shallow peduncle and the long base of the soft dorsal are immediately diagnostic, even in juveniles, as are in effect also the body shape and markings.

Fowler (*loc. cit.*) stated that *Drepanoscorpis* has only a single series of teeth. The two inner series of teeth are actually very easy to overlook, being concealed within fleshy pads, and the teeth are small and fragile. They are incisiform, and not conical in shape, as usually stated. There are several inconsistencies between the description and figure of *gilchristi* (*loc. cit.*).

D. multifasciatus is rarely if ever encountered west of Algoa Bay. A single small specimen was taken in a rock pool at Knysna.

This species does not appear to grow as large as the other two, 300 mm. apparently being an outside length.

In so far as can be ascertained, it is unusual for *multifasciatus* to be captured on lines at the same time as the other species or under equivalent conditions. The latter may be taken in broken water, relatively shallow, on sandy as well as rocky bottoms, whereas *multifasciatus* appears to prefer exclusively rocky haunts and clearer water, being generally taken in deeper water, often in gullies at low tide. It has been noticed that when this species is taken, other fishes, especially larger fishes, are generally absent.

On the eastern coast of South Africa, where all three species may be found, the flesh of *multifasciatus* is generally regarded as superior to that of the others, being lighter in colour and of less pungent flavour. The natives of this area constantly distinguish *multifasciatus* from *falcatus* (known as "Damba") by names indicating its fondness for rocky haunts. The two native names mean "Pick up a stone" and "Stone-maiden."

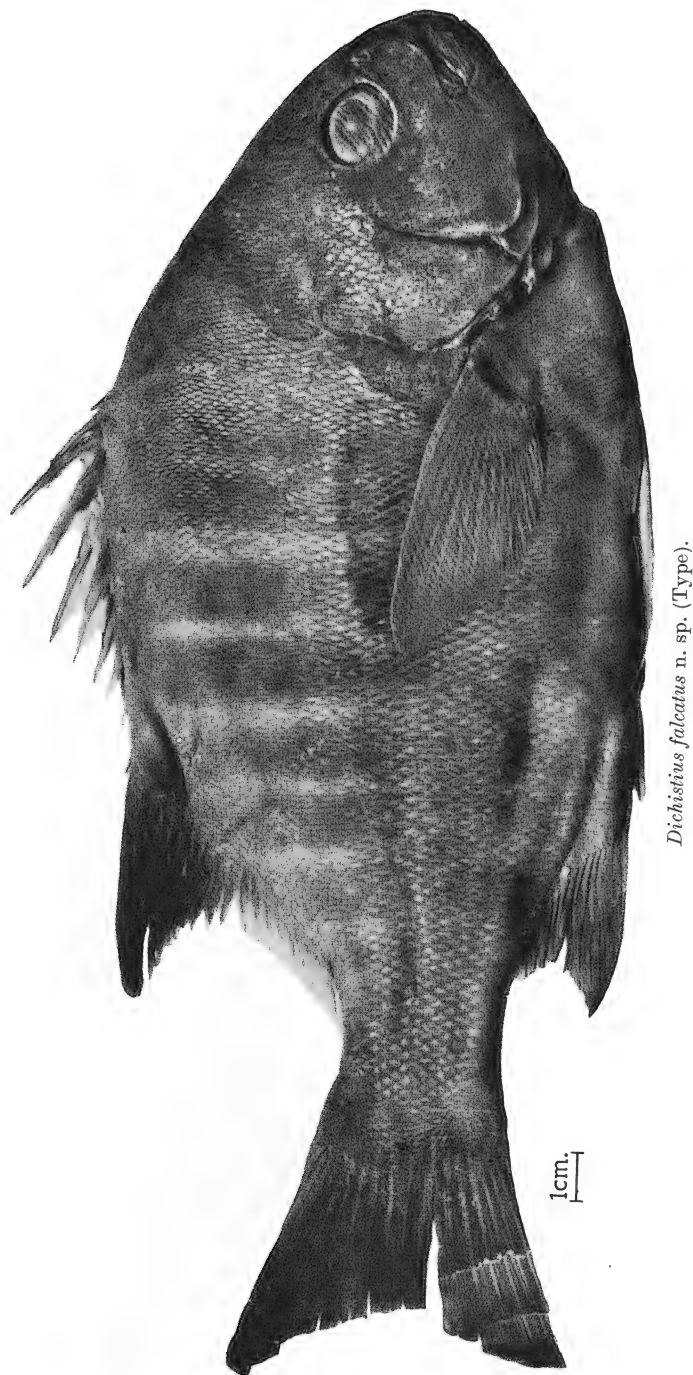
I wish to express my gratitude to Dr. Barnard, of the South African Museum, for the loan of material. To numerous friends, especially J. Rex Meterlerkamp, Esq., of Knysna, for valuable assistance rendered in securing material. Also to the South African Research Grant Board (Carnegie Fund) for generous financial assistance.

The Council desires to acknowledge the receipt of a grant from The Research Grant Board towards the cost of publishing this paper.



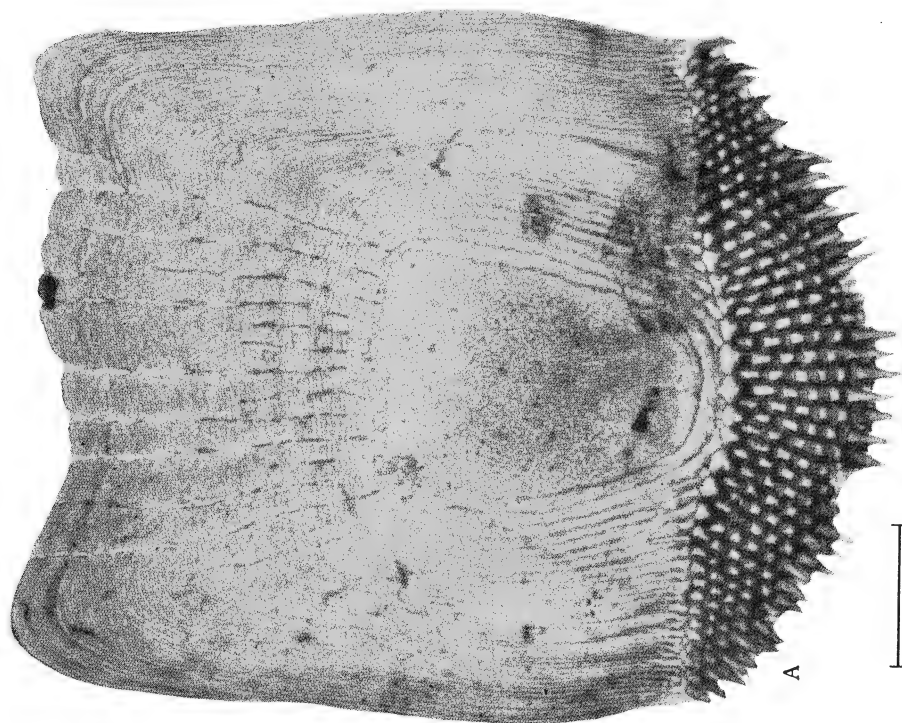
Dichistius capensis (C. and V.) (Juvenile).

1 cm.



Dichistius multifasciatus (Pell.).

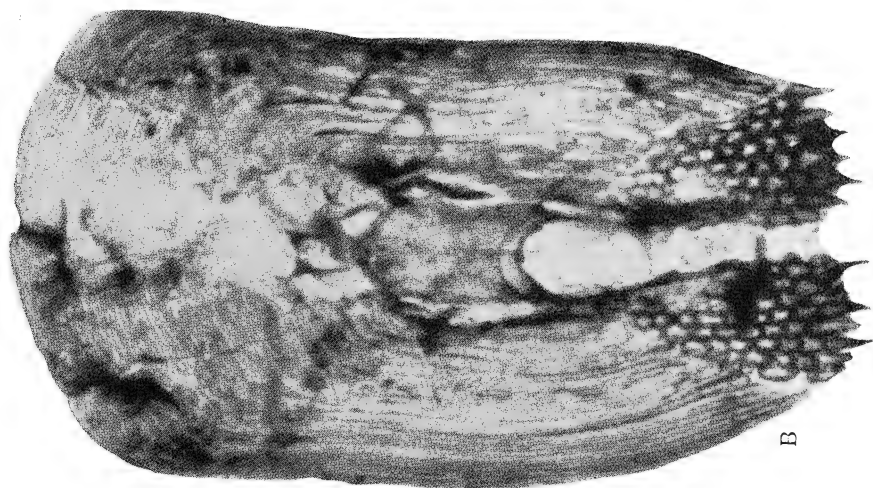




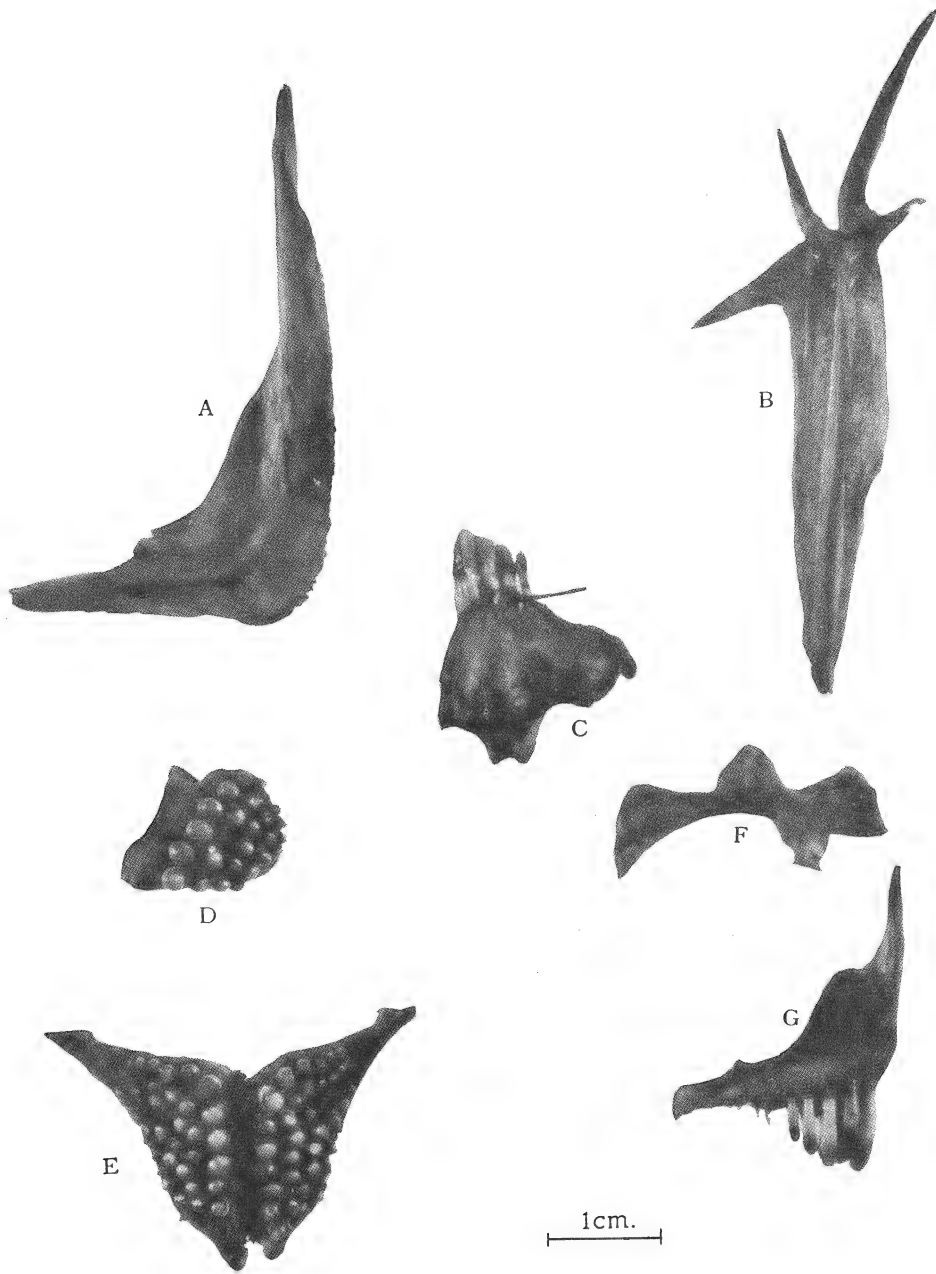
Scales of *Dichistius multifasciatus* (Pell.).

A. 24th lateral scale adjacent to lateral line.

From specimen 230 mm. total length. The line below each scale represents 1 mm.



B. 20th lateral line tubular scale.



Dichistius falcatus n. sp.

A. Preopercle. B. Anterior dorsal spines. C. Mandible from behind: the line indicates posterior teeth. D. Middle upper pharyngeals. E. Lower pharyngeals. F. Maxilla. G. Premaxilla. From specimen 285 mm. length.

Records of the Albany Museum. Vol. IV. Part II. pp. 169–235.
Pls. XVIII–XXIII. May, 1935.

New and Little Known Fishes from South Africa.

[With Plates XVIII–XXIII, and 5 text figures.]

By J. L. B. SMITH.

Family MYLIOBATIDAE.

Myliobatis cervus n. sp. [Text fig. 1.]

“PYL-STERT” (Knysna.)

Disc about 1.75 times as wide as long. Pectoral tips moderately pointed, sub-falcate. Snout not very blunt, rounded, with apical point. Flanges on side of head, connecting rostrals with pectorals, very narrow. A circular flap of the iris projecting over most of the pupil from above. Males with a small conical horn above the orbit. Dorsal small, projects beyond hind margin of base, originates 3-3½ lengths of base behind posterior margin of ventral base, 1-1½ lengths of base behind end of ventrals. Males with two serrated caudal spines, posterior longer, females with one or two spines. Caudal 1½-2 times as long as disc. Central series of teeth 4-5 times as wide as long. Skin smooth, no tubercles. Colour uniform brown.

Size, up to 4 ft. across the disc (females), males usually much smaller.

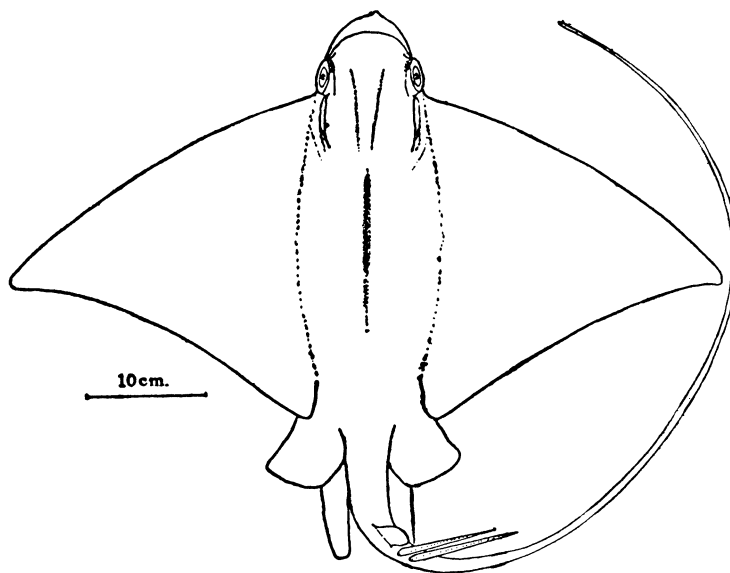
Localities: Cape Agulhas, Knysna estuary, Bushmans River, Port Alfred, Great Fish Point.

Types (one male, one female) in the Albany Museum, from Knysna.

I have examined a large number of specimens of both sexes, and find that the females would all be referable to *aquila* Linn, except for the shape of the snout, which is somewhat more pointed in *cervus* than in *aquila*. This is apparently the only difference between the females. The orbital horn of the males of *cervus* is very slight. Full specific distinction of *cervus* from *aquila* is of perhaps doubtful validity, since the females of these species cannot easily be distinguished one from another.

Cervus is distinguished from the related species *tobyei* Bl., by the wider disc and by more posterior insertion of the dorsal. According to Garman (Mem. Mus. Comp. Zoo. vol XXXVI, p. 431), *cornuta* Gnthr. is a synonym of *tobyei*.

Aquila is more common at Knysna than *cervus*: both are present in fair numbers during the summer months. The females appear to seek out the shallow banks in the river, where the young are born. One large female after capture gave birth to seven young, which were 200-230 mm. across the disc. These "rays" are evidently preyed upon by various species of "sharks." On one occasion a large specimen of *aquila* was observed to take refuge in a few inches of water on the edge of a bank in the river, violently beating the water with the pectorals in an effort to scare off a large "shark" which lay close in, with part of the body out of the water. The specimen of *aquila* was secured and proved to be an adult female, 3 young being born after capture. On another occasion a large female of *aquila* was taken on a line, and proving too large to lift into the boat, was tied to the bows. Several young were born and drifted down with the tide. Shortly afterwards a large "shark," some 9ft. in length, appeared, and seized one of the newly-born young.



Text fig. 1. *Myliobatis cervus* n. sp. Male.

Family SYNGNATHIDAE.

Hippocampus capensis Blgr.

1900. Boulenger, Mar. Invest. S.A. vol. i, p. II, Pl. III, fig. 2.

1916. Thompson, Mar. Bio. Rep. vol. III, p. 90.

1925. Barnard. Ann. S.A. Mus. vol. XXI, p. 293.

Head (snout to gill opening) 1.5-1.9 in trunk (gill—opening to last body ring). Trunk 1.9-2.1 in tail. Snout, short and straight, 2.6-3, eye 4.5-5.5, postorbital part of head 2.1-2.4 in length of head. Coronet reduced, almost obsolete, a very small tubercle at each end of median occipital keel. Faint radiating ridges on opercle.

Rings 11+33-36. Tubercles on head and body small and obtuse but distinct, the supero-lateral on the first, fourth, seventh, tenth and last body rings enlarged. Tubercles on fourth, sixth and eighth tail rings usually enlarged and less obtuse than the remainder. Plates smooth, ridges distinct. No filaments.

D 16-18, sub-dorsal rings 2-3+1. Ridge below dorsal about half eye diameter in height posteriorly. 3 enlarged sub-dorsal tubercles, one on the 10th, and two on the last body ring.

A 4; P 15-17.

Colour: Light to dark brown, uniform, or with dark spots. Dorsal fin with black sub-marginal band.

Length: Up to 110 mm.

Locality: Knysna.

Plesiotypes from Knysna in the Albany Museum.

As indicated by Barnard (loc. cit.), Boulenger (loc. cit.) states that there are 10 body rings, whereas his figure shows 11. A large number of specimens, ranging from 33-110 mm. in length, has been examined, and the number of body-rings is constantly 11. The original description is also inaccurate in other particulars, notably in stating that tubercles are not present on the head and body, whereas the figure shows them to be present.

This species is rather scarce even in the Knysna river, which is the only locality from which it has been recorded. Specimens

have several times been found in the stomach of the "Dasje."
(*Diplodus capensis* A. Smith.)

Capensis is closely related to *kuda* Blkr, but the rudimentary coronet and the very short snout distinguish it sharply from the latter species.

Family CLUPEIDAE.

Sardinella melanura Cuv.

1888. Day, Fishes of India, p. 636, Pl. CLXIV, fig. 5
(*atricauda*).

1925. Fowler, Proc. Ac. Nat. Sci. Phil., vol. LXXVII, p. 194.

Body compressed, belly cultrate, with scutes. Depth 3.7-4, length of head 4.2-4.3 in length of body. Eye 3.5, interorbital 4.0, snout 3.3, and postorbital 2.4 in length of head. Interorbital concave, grading forward into an obtuse mesethmoidal ridge. Posteriorly converging parietal ridges. Arborescent muciferous canal system on cheek. Adipose eyelids well developed, both extending to pupil. Mouth very oblique, lower jaw projects, maxilla extends to below anterior margin of pupil.

No teeth visible in jaws, or on vomer. Traces of fine teeth on palatines, and clearly visible on tongue. Gill rakers 37-40, 2 in gill filaments, which are slightly less than eye. Branchiostegals 6.

D 17-18, inserted 1.4 times further from caudal base than snout tip, midway between snout tip and middle of anal. Longest ray, 3rd, 1.6 in head, decreasing posteriorly, last ray longer than penultimate. Base of dorsal 1.7 in head.

A 18-21, inserted 3.3 times further from snout tip than caudal base, longest, anterior, rays 5 in head. Last ray much longer and thicker than penultimate. Base of anal 1.5 in head. P. 15, 1.4 in head, inserted low down, below the hinder third of the sub-opercle. V. 8, 2.1 in head, inserted below the 3rd dorsal ray. Caudal deeply forked.

Scales cycloid, not deciduous, l.l. 44-48, ltr. 10-11; 16-17 preventral, 14 post-ventral scutes. Head naked. Dorsal and anal with heavy scaly basal sheath.

Colour: Dark green-black above, silvery below. Interorbital, snout and tip of lower jaw dark. Dorsal and caudal dusky. Remaining fins light.

Length: Up to 160 mm.

Locality: Durban, taken in the surf.

Distribution: East coast of Africa to the Indo-Pacific.

These specimens described above appear to be conspecific with *melanura*, except that the dorsal appears to be rather far forward.

This is the commonest Clupeid at Durban, at any rate in the winter months.

Family OPHICHTHYIDAE.

Ophichthys marginatus Peters.

1866. Gunther. Fish. Zanz. p. 128 (*Ophiurus m.*).

1870. Gunther. Cat. Fish. Brit. Mus. viii, p. 64
(*Ophichthys m.*).

Body cylindrical. Head small, 6.3 in body from gill-opening to vent, 18 in total length. Cleft of mouth extends behind eye, 3 in length of head. Eye small, 2.5 in snout. Tail 1.7 in total length, 1.7 times body from gill-opening to vent. Anterior nasal tube longer than eye (not very short). Snout blunt and moderately swollen at extremity, lower jaw much shorter than upper. Teeth moderate, conical, pointed, biserial in both jaws.

Pectorals short, 3.1 in head. The dorsal commences above the middle of the pectoral and is very low, being received into a deep groove. Anal similar to dorsal.

Skin on head deeply corrugated longitudinally.

Colour: Uniform light brown, head darker.

Length: 430 mm.

Locality: Knysna.

Distribution: East coast of Africa.

This specimen differs from the descriptions of *marginatus*, notably in the greater length of the tail, and in the not markedly short anterior nasal tube. It is at present provisionally assigned to *marginatus*, with the diagnosis of which it agrees closely.

It is singular that this species has not previously been discovered in the waters of Natal. Its presence as far south as Knysna is interesting and confirms the view expressed elsewhere that the Indo-pacific species extend more generally westwards along our coast than has hitherto been suspected.

Family MYCTOPHIDAE.

Myctophum (*Diaphus*) *elucens* Brauer. [Text fig. 2.]

1906, Brauer, Tiefsee Exp. vol. XV, p. 219, fig. 140.

1913, Gilbert, Mem. Carneg. Mus. VI, p. 93, Pl. XII, fig. 2. (*gigas*).

1928, Parr. Bull. Bing. Ocean. Coll. III, p. 121 and p. 138 ff.

Depth 4.3-5.3, length of head 3.4-3.8 in length of body. Eye 4, snout, 6.4-7, interorbital width 3.3, and postorbital 1.6 in length of head.

Mouth large, extends well behind eye, cleft of mouth 1.4 in head. Maxilla scarcely dilated posteriorly. Gill rakers 6+12-13, longest 2 in eye.

D 14-15, originates 1.3 times further from caudal base than from tip of snout.

A 15, originates below end of dorsal.

P 12, 2.3 in head, does not reach ventral base.

V 10, inserted below dorsal origin, 1.8 in head, inner rays longer, scarcely reaches vent.

Antorbital organs very large. Lower antorbital continuous above and below nostrils, occupying most of snout, narrowly separated in front along the mesethmoidal ridge. Upper antorbital smaller, rounded, situated immediately above the orbit, separated from the lower organs by a moderately wide black septum.

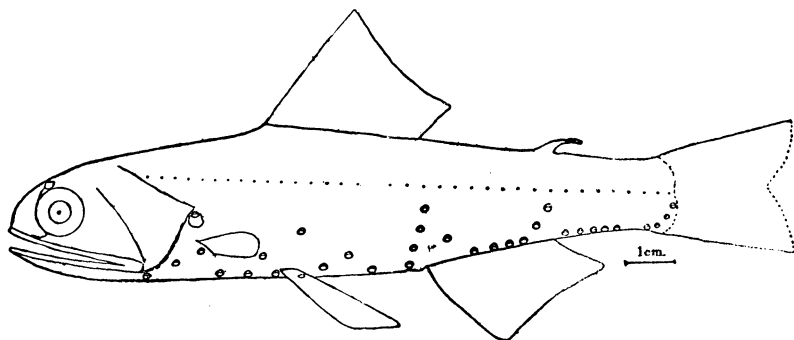
Photophores with a curved black septum. PLO twice as far from lateral line as from pectoral base, with a luminous scale below. PVO 2, both below pectoral base, form an oblique straight series with first PO. PO 5, 4th elevated above the rest to level of pectoral base. VLO midway between lateral line and ventral base, slightly behind ventral origin. VO 5, 2nd and 3rd elevated above the rest, 3rd highest. SAO 3, form an oblique,

equally spaced series with last VO, highest three times as far from ventral profile as from lateral line. Pol. 2.3 times as far from anal base as from lateral line. AO 6+5; antero-AO form a gently curved series, convex below, first and last at same level: postero AO straight. Prc 4, widely separated from AO, form a curved series, last high up, twice as far from ventral profile as from lateral line.

Scales: l.l. 36, no luminous scales except a single scale below PLO. Scales mostly shed.

Colour (preserved) uniform brown. Antorbitals bright silvery.

Two specimens, 145 and 165 mm. in length, precise locality unknown, but probably Natal, having been found among unclassified fishes from Natal presented to the Albany Museum by the Director of the Fisheries Survey.



Text fig. 2. *Myctophum elucens* Brauer.

These specimens are in fairly good condition except for the absence of most of the scales.

Parr (loc. cit) appears to be fully justified in uniting *gigas* with *elucens*.

The specimens described above are clearly conspecific, differing in minor features, such as the distinctly smaller eye.

This species has been recorded from just south of the equator on the East Coast of Africa, so that its presence in the waters of Natal is to be expected. With further collecting it may be discovered on our South Coast.

Family ALEPISAUROIDAE.

Alepisaurus ferox Lowe.

1895. Goode and Bean, Ocean. Ichth. p. 117, fig. 142.

1925. Barnard, Ann. S.A. Mus. vol. XXI, p. 250, Pl. X, fig 2.

The only specimen hitherto recorded from South Africa was from East London, described by Barnard (*loc. cit.*)

Another specimen, 900 mm. in length, has since been cast up at the Mbotyi river mouth (Transkei) and has been forwarded (dried and shrunken) to the Albany Museum by Mr. W. W. Roberts.

This specimen is undoubtedly conspecific with *ferox*, as it agrees with the general diagnosis in all particulars which can be determined with certainty; D 40, A 17, P 14, V 9.

Eye $2\frac{1}{2}$ in snout: head 6 in body. Gill rakers about 20 (probably a few more) fine, bifid.

Barnard's opinion (*loc. cit.*) that there is only one species in this genus is probably correct. It may be noted that the finder reports that this specimen did not have the characteristic enlarged upper caudal lobe (both now broken). This is not important, as the feature may prove to be of secondary sexual significance only.

Family CORYPHAENOIDIDAE.

Lionurus nasutus n. sp.

Body compressed. Snout pointed, flattened above and below, projects almost an eye diameter beyond vertically above the tip of the upper jaw.

Depth 7.4, length of head 4.9 in total length. Eye 3.3, longitudinal length of orbit 3, of snout and interorbital 3.2, and postorbital 2.5 in length of head. Upper jaw length 3.1 in head. Barbel 1.4 in eye. Mouth sub-lateral, maxilla extends to below posterior margin of pupil. Minute pluriserial conical teeth in upper jaw. Similar teeth in 2-3 series at symphysis, in a single row on side of mandibles. Vomer, palatines and tongue edentate.

Gill-openings wide, rakers 13, tubercular. First gill-slit reduced by a membranous fold. Branchiostegals 7.

Vent in scaleless fossa slightly behind insertion of ventrals.

D 2, 9 + many, originates above the hind margin of the operculum, 1st spine minute, 2nd 1.5 in head, serrated along entire front edge. First ray almost as long as 2nd spine.

A ca. 140, originates below the distal part of the pectoral, anterior rays slightly longer than posterior, graduated. P. 17, 1.7 in head, V, 8, 2.5 in head.

Body scales with 6-7 rows of spinules, posterior spine longest. (Fig. 3.) Cycloid scales on shoulder girdle. Scales on head with spiny tubercles arranged in quincunx. Six series of scales between dorsal origin and lateral line.

Colour: (preserved) Uniform light brown.

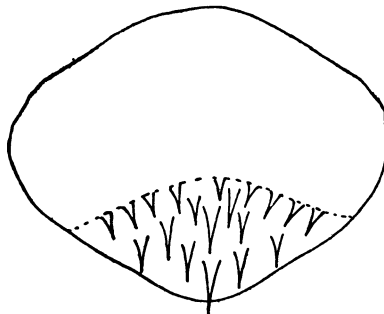
Length: 243 mm.

Type, a single specimen in the Albany Museum.

Locality: Precise locality unknown, having been found among some unlabelled specimens, collected by S. S. Pickle, presented to the Albany Museum by the Director of the Fisheries Survey.

This species differs from the other South African species of *Lionurus*: the snout is much more elongated, and the gill-rakers are greater in number.

I am unable to identify this specimen with any species described in the literature at my disposal, but as there are numerous nominal species, *nasutus* may eventually be found to be identical with some known form.



Text fig. 3. To show the arrangement of the spinules on a body scale of *Lionurus nasutus* n. sp. $\times 15$.

Family ATHERINIDAE.

Iso natalensis Rgn. [Pl. XIX, fig. C.]

1919, Regan, Ann. Durb. Mus. vol. II, p. 200, fig. 3.

1925, Barnard, Ann. S.A. Museum, vol. XXI, p. 300.

Body very compressed, maximum width at shoulder 2.9 in depth, tapers ventrally. Ventral edge cultrate. Breast sharply keeled: a median cultrate thickened fold of skin along belly. Dorsal profile even, gently convex from snout to caudal, with slight concavity above eye. Snout bluntly rounded. Body tapers rapidly behind ventrals. Depth 3.4, length of head 5 in length of body. Eye 3.1 in head, equal to snout, 1.2 in interorbital width and in the postorbital part of the head.

Mouth very oblique, almost vertical, lower jaw shorter, included in upper, edge of upper jaw curved. Maxilla, excluded from margin of upper jaw, extends to below posterior third of snout. Minute curved conical teeth in a single row in each jaw. Similar teeth on vomer and palatines. A large cutaneous process in roof and in floor of mouth across symphysis. Lips moderate, finely papillose. Opercular bones entire. Gill-openings wide, membranes free. Gill-rakers 11, slender, almost as long as eye, 1.5 in gill-membranes. No slit behind last gill. Branchiostegals 5. Pseudo-branchiae present.

D VI + 1, 15. First dorsal originates slightly in advance of midway between tip of snout and base of caudal, well behind midway between ventral and anal origins. Spines very slender, first longest, 3.5 in head, remainder decrease, 6th spine very short, membrane scarcely incised. Second dorsal originates 1.7 times as far from tip of snout as from base of caudal, above the 7th anal ray; spine subequal to eye. Anterior rays slightly elevated, 2.2 in head, edge of fin gently concave, last and penultimate rays slightly longer than preceding rays. Base of first dorsal 2.6, of second dorsal 1.1 in head.

A 1, 26. originates midway between caudal base and hind margin of eye. Spine short. Anterior rays slightly elevated, first longest, 1.9 in head. Edge of fin gently concave. Base of anal 1.3 times head.

P 13, 1.4 in head, upper margin of base close to dorsal profile.

V.1, 5, 1.9 in head, inserted slightly more than twice as far from caudal base as from tip of snout.

Caudal 8+18+8, forked, peduncle twice as long as deep.

Scales cycloid, small, no basal striae. Scaling extends to base of anal and obliquely up as far as midway between tip of pectoral and origin of first dorsal. Lat. ser. 74, 6 from origin of first dorsal to lateral stripe, and 6 series across lateral stripe. Eight series across peduncle. Head, belly and nape scaleless.

Colour. (Alive). Light blue-green above, silvery white below. A bright silvery lateral stripe with dark upper margin, 1.3 times as wide as eye, from pectoral base to peduncle, tapers posteriorly from second dorsal. A silvery blotch on caudal base. Opercular bones dull silvery. Nape dusky. Fins light.

Length: 73 mm.

Locality: Knysna.

Distribution: South and East coasts of Africa.

Plesiotype in the Albany Museum.

A single specimen, taken in the surf at Knysna Heads.

In the summer months at Knysna, a cold current, of temperature 50°F., frequently sets inshore, numbing innumerable fishes. This small specimen did not appear to be inconvenienced by this cold water, since it was able to swim at a remarkably rapid rate, and was captured with great difficulty. A larger specimen, at least 100 mm. in length, was also observed, but it evaded all attempts at capture.

The above diagnosis differs in several particulars from that of the holotype, chiefly in the presence of 6 spines in the first dorsal and in the greater number of anal rays, as well as in the shape and size of the mouth. Since the original description is somewhat meagre I submitted the Knysna specimen to Mr. Norman, of the British Museum, who compared it with the type of *natalensis*. He is of opinion that, making allowance for the difference in size, the two are conspecific. The type is somewhat damaged, and Regan's figure (*loc. cit.*) is not quite accurate.

Family GADIDAE.

Merluccius capensis Cast.

A juvenile specimen of this species has been received from Mr. A. M. Vardy, which was taken some half mile up the Gamtoos river. Also Mr. Vardy states that a large adult specimen was taken in the same river a few years ago. In view of the normally bathybial habit of this species, the occurrence in a relatively shallow tidal river is remarkable, all the more so since the waters of this river normally carry a considerable amount of suspended earthy matter.

Family CETOMIMIDAE.

Cetomimus picklei Gilch.

1922, Gilchrist, Fish. Mar. Surv. Spec. Rep. III, p. 56, Pl. IX, fig. 1 (*Pelecinomimus picklei*).

Body moderately compressed. Depth, behind head 7, at origin of dorsal 7, midway along body 9, in length of body. Head 3.3 in body. Snout, about equal to interorbital width, 2.4 in head. Eye rudimentary, just above maxilla. Mouth very large, cleft 1.2 in head. Maxilla, excluded from margin of upper jaw, dilated posteriorly. Minute compressed triangular teeth in 3-7 series in lower and 3-5 series in upper jaw, bands tapering posteriorly, symphysis edentate in both jaws. Similar teeth on vomer, palatines, pterygoids, and on all gill-arches. Tongue rudimentary. Gill-opening wide, gill-filaments few, about 7 in head. No gill-rakers. Branchiostegals 8. Caudal damaged, peduncle fairly compressed. Lateral line a single wide tube with about 10 large pores between opercle and caudal base. Large pores on head. Suborbital produced into a bifid spine which projects laterally above the hind end of the maxilla. Preopercle with a flat spine at angle just behind angle of mouth.

The skin on the body is very loose and flabby, scaleless, nor are any traces of scale pockets to be observed.

D 16, commences 3.3 times as far from snout as from base of caudal, posterior rays longest, 2.4 in head. Length of base of dorsal 1.3 in base of anal.

A 16, commences slightly in advance of the dorsal, shape similar to dorsal.

P 18, inserted low down on side, 2.3 in head.

Colour: Uniform black.

Length: 66 mm.

The above description is based upon a re-examination of the type (and only known) specimen of *picklei*. The original description is very brief and misleading. Gilchrist (loc. cit.) states that scales are present, "very long scales," and mentions this feature as a characteristic of the genus *Pelecinomimus* Glch. As indicated above, there is absolutely no trace of any scales, and it is difficult to account for Gilchrist's positive statement to the contrary. Both the skin and the lateral line are similar to those described for other members of this family. Further, the body does not taper uniformly from the head, but is narrowest midway, after the manner of that of *regani* (Zugm.), but the median construction is not so pronounced in this case. The size and position of the eye are, in these of all fishes, scarcely features of generic significance, and there appears at present to be no valid reason for the maintenance of *Pelecinomimus* as distinct from the type genus.

It may be indicated that Barnard (Ann. S.A. Mus. 1925, vol. XXI, p. 252) who did not see the specimen, was doubtful of the accuracy of the statement about the presence of scales.

Family EXOCOETIDAE.

Cypselurus hewitti n. sp.

Body moderately compressed, sub-quadrangular in section, 1.6 times deeper than wide. Depth 5.6, length of head 4.1 in length of body. Eye 4 in head, 1.4 in interorbital, slightly greater than snout and 1.8 in the postorbital part of the head. Head moderately depressed, interorbital gently concave with two slight longitudinal grooves. Top of head scaly. Minute conical teeth in a single series in each jaw. Vomer and palatines edentate. Maxilla extends to below nostrils. A pair of flat fringed tapering barbels at symphysis of lower jaw, 2 in head, width at base 8-9 in head. Gill-rakers 21, 2 in gill-filaments which are 1.6 in eye. Branchiostegals 10.

D 13, arising 2.5 times as far from base of caudal as from base of ventral. Edge of fin highly convex. 1st ray 1.4, 2nd 1.7, 3rd longest, 1.1, last ray 4 in head; fin scaleless.

A. 10, commences below 6th dorsal ray. Edge of fin convex. 1st ray 3.5, 6th longest, 2.2, last ray 4 in head. Length of base of anal 1.5 in base of dorsal. Fin scaleless.

P 14, reaches almost to base of caudal, first ray simple, 3rd ray longest. Base of fin scaly.

V 6, 1.3 times head, inserted midway between base of caudal and hind margin of preopercle, 3rd ray longest, 1st shortest: a few basal scales. Caudal deeply forked, upper lobe shorter, 1.5 in lower. Mid-rays 1.4 in eye.

Air-bladder simple.

Scales: lateral rows 56. L.l. 56, 28 from chest to base of ventral. 32 pre-dorsal scales, 8 above lateral line. l.l. tubes with 5-6 postero-inferior tubules. Scales with 5 radiating basal striae.

Colour: Brownish above, lighter below. Pectorals dark with upper margin light. Distal $\frac{3}{4}$ of ventrals dark. Dorsal and anal dark with light anterior margin. Caudal light. Barbels dark.

Length: 215 mm.

Locality: Port Alfred.

Type in the Albany Museum.

The present species resembles *bahiensis* Ranz, but differs in the presence of the mental barbels, in the absence of palatine teeth and in the larger number of scales. It may be noted that Weber and de Beaufort (Fishes Indo-Aus. Archip. 192, IV, p. 190) state that *bahiensis* has 48 lateral rows of scales, while Fowler (Fishes Oceania, Mem. B. P. Bish. Mus. 1928, X, p. 84) gives 48-57.

Family TRACHICHTHYIDAE.

Hoplostethus gilchristi n. sp. [Pl. XXII, fig. E.]

Body ovate, deep, moderately compressed. Dorsal profile even, snout fairly blunt. Depth 2.2, length of head 2.6 in length of body. Eye 4.2 in head, slightly less than snout, 1.4 in inter-orbital width.

Head bony, ridged, ridges covered by thin skin, with muciferous pores and canals. Ridges mostly minutely serrate. A strong spine at the angle of the preopercle. Indications of a subopercular spine. No spine on opercle. A large suprascapular spine, connected to the side of the nape by a large scale, which has a denticulate hinder margin. Nostrils circular, close together, posterior very large.

Mouth large, very oblique, moderately protractile. Maxilla extends to well behind eye, to about below the upper angle of the preopercular limb. Maxilla excluded from the margin of the upper jaw. Supramaxilla present. Lower jaw almost included in upper. Villiform teeth in both jaws in bands, wider anteriorly. An edentate symphysial notch in upper jaw, into which fits a corresponding dentate knob on the upper surface of the lower jaw. A median tubercle on chin. Vomer edentulous. A single series of villiform teeth on the palatines, triserial in a small anterior patch.

D VI, 17 (or V, 18), commences over the 4th lateral line scale, behind the base of the pectoral. 1st spine very short, remainder increase to the 6th, which is about 4 in head. Soft rays higher than the spines: mid-posterior longest, almost 2.5 in head. Posterior margin of fin rounded. Anterior rays indistinctly articulated.

A III, 11, commences below the base of the 10th dorsal ray. First two spines very short, 3rd abruptly longer, about 5 in head. Soft rays longer than the last spine: mid-posterior longest, about 2.7 in length of head. Posterior margin of fin rounded.

P 20, 1.5 in length of head, extends to above the vent. Base scaly, oblique.

V 1, 6, inserted below the base of the pectoral, 2 in head, not reaching to vent.

Caudal deeply forked, lobes lanceolate, VII+21+VII. Peduncle longer than deep.

Scales strongly ctenoid, those of the lateral line vertically elongate, twice as high as wide. 33 scales in lateral line. Large perforation in each l.l. scale covered by a denticulate flap hinged anteriorly. Body scales are one third linear of l.l. scales. About

11 scales above and 23 below l.l. Abdominal scutes 18, very feeble. Mentum and lower portion of preopercular limb scaly, rest of head naked. Gill-openings very wide, membranes free. Gills 4, no slit behind the 4th. Gill-rakers 14, long and fairly stout, 2.5 times the gill-filaments and 4.5 in head. Pseudo-branchiae present. Branchiostegals 8.

Colour: (preserved) uniform red-brown. Inside of mouth and gill cavity black.

Type in the Albany Museum.

A single specimen, 238 mm. in length, taken in 300 fms. off Durban by S. S. "Pickle," was presented to the Albany Museum by the Director of the Govt. Fisheries Survey.

It appears not unlikely that the late Dr. Gilchrist had recognised this specimen as differing from the commoner *mediterraneus* (C & V), since it had evidently been separated from specimens of this latter species.

Gilchristi is intermediate between *mediterraneus* and *atlanticus* (Coll.). It differs from the latter in the larger body scales as well as in other characters. It differs markedly from *mediterraneus* in the much shorter paired fins, as well as in the numerically greater but much weaker abdominal scutes.

In the specimens of *mediterraneus* I have examined, a long, slender opercular spine is present, which resembles closely that found in *Gephyroberyx darwini* (Lowe). The present species has no opercular spine.

Family GRAMMICOLEPIDAE.

Xenolepidichthys dalgleishi Glch. [Pl. XVIII, fig. A.]

1922, Gilchrist, Fish. Mar. Surv. Spec. Rep. vol. III, p. 73, pl. xii, fig. I.

1925, Barnard, Ann. S.A. Mus. vol. XXI, p. 370.

Body very compressed, deep, subrhombic, dorsal profile steep, almost straight from snout to dorsal origin. Depth 1.2 times length of body: head 2.7 in length of body. Eye 2.5 in head, slightly greater than snout and 1.6 times interorbital width.

Supraorbital ridge serrate, terminating in a tri-dentate laterally projecting ridge, one third of eye diameter, above the hind margin of the eye. Mouth very small, terminal, scarcely protractile. Maxilla extends to almost below anterior margin of orbit. Gill-membranes united, scarcely united with isthmus. Gill-rakers short, 15 on lower part of anterior arch.

D. V. 27, originates above hind margin of head. First spine minute, second with a double series of barbs behind, filamentous, 2.4 times length of body; 3rd spine as long as body, 4th half as long as the second, 5th shorter. Soft rays about 2.2 in head, slightly longer posteriorly. A series of short spines, being enlarged scales, along the base of the fin.

A II, 27, originates below the 10th dorsal ray. First spine, serrulate behind and in front, very elongate, filamentous, twice the length of the body: second spine broken at base, probably also elongate. Soft rays similar to dorsal rays. Short spines along base of fin.

P. 14, 1.8 in head.

V 1.6, 2 in head.

Caudal emarginate, upper lobe longer.

Scales vertically elongate, l.l. 83, strongly arched anteriorly.

Colour: Bright silvery-yellow, with round black spots arranged more or less in three longitudinal rows, the upper following the dorsal, the lower the ventral profile. Two dark bars across the hinder part of the peduncle. Hinder margin of caudal dusky. Base of anterior dorsal spines dark.

Length: 43 mm.

Locality: Great Fish Point.

This specimen was cast up by the waves after a storm, and is in an excellent state of preservation. Specimens of this species are sometimes picked up on the shore in the neighbourhood of Port Alfred, but this is apparently the smallest specimen hitherto secured. The extremely elongate 2nd dorsal and 1st anal spines are possibly a juvenile characteristic, but may also persist in the adult stage, since the shorter 1st anal spine of larger fishes resembles the broken proximal portion of a longer growth.

Family OPISTHOGNATHIDAE.

Opisthognathus marrostromus n. sp. [Pl. XX, fig. B.]

Body compressed, moderately elongate. Head large, rounded, interorbital concave. Snout very blunt, abruptly descending before eyes.

Depth 4.3, length of head 2.9 in length of body. Eye 4 in head, twice snout and interorbital width, 2.8 in postorbital part of head. Preopercle without free hind margin, hidden below skin. Mouth very large, oblique, cleft extends to well behind the posterior margin of the orbit. Maxilla enlarged, with supra-maxilla, extends to almost below the hinder margin of the operculum. Very slight membranous connection with cheek. Each jaw with a single series of fine conical teeth along the sides: 4 series in upper and three series in lower in a narrow symphysial patch. Vomer and palatines edentulous. A single pair of dentigerous upper pharyngeals, teeth blunted, conical. Lower pharyngeals apparently fused, dentigerous. Tongue rounded, free. Gill-opening wide, membranes free from isthmus. Gills 4, a slit behind the fourth. Gill-rakers 25, slender, 1.4 times gill-filaments and 2 in eye. Pseudobranchiae present. Branchiostegals 6.

D XI, 13, commences in advance of the hind margin of operculum. Spines feeble, 1st 3.5 in head, remainder increase in length to the 7th and 8th which are 2 in head, remainder decrease to the last which is 2.4 in head. Anterior rays very slightly shorter than last spine, remainder increase to the 10th which is 2.2 in head, thereafter decrease to the last. Posterior 8 rays branched. Whole fin enveloped in thin skin.

A 16 (or II, 14), commences below the base of the last dorsal spine. First two rays spiniform. 1st ray less than an eye-diameter, remainder increase to the 14th which is 1.3 times an eye-diameter. Posterior 7 rays branched. Whole fin enveloped in thin skin.

P 20, rounded, 2.7 in length of head.

V I, 5, half the length of the head, inserted in advance of the base of the pectoral. Bases close together; fin enveloped in skin spine feeble and indistinct.

Caudal 15, rounded, 2.0 in length of head. Peduncle deeper than long, very compressed.

Scales cycloid, very small. Lateral line commences on head above hind margin of preopercle, and has transverse branches ending in pores. These branches are arborescent on the anterior portion of the lateral line, becoming simple posteriorly. Lateral line extends below $\frac{3}{4}$ of the dorsal, ending below the 8th dorsal ray.

Head naked, skin densely pitted, with many arborescent muciferous tubules.

Colour: Brown, mottled with darker. Lower margin of, and a patch on hind portion of, maxilla black. Ventrals, hinder margin of caudal and portions of dorsal, dusky. Remaining fins light. A dark blotch on the dorsal between the 5th-9th spines.

Type: A single specimen 160 mm. in length, from Natal, precise locality unknown, found among certain fishes collected by S.S. "Pickle" in Natal waters, presented by the Director of the Govt. Fisheries Survey to the Albany Museum.

This species is close to *nigromarginatus* Ruppel. It differs from this species in several features: in the number of dorsal spines, in the wider interorbital, in the extent of the lateral line, and in the slightly smaller expansion of the maxilla, together with the absence of a membranous connection between the cheek and the hinder extended portion of the maxilla.

Family CALLIONYMIDAE.

Synchiropus monacanthus n. sp.

Dorsal profile flat, with an abrupt interorbital prominence, sloping before eyes. Body moderately compressed, sub-cylindrical. Head (tip of snout to gill-opening) 1.2 times as long as broad, fairly depressed.

Depth 6.7, length of head (to gill-opening) 3.6 in length of body. Eye 3 in head, slightly greater than snout and 6 times the interorbital width. Preopercular spine 5 in head, no antrorse spine at base, a single denticle, $\frac{1}{3}$ length of spine, on distal third, directed inwards and forwards. Eyes partly lateral.

Mouth moderate, fairly protrusible obliquely downwards. Maxilla not concealed beneath the preorbital, extends to barely below the anterior border of the eye. Slender pointed teeth in bands in both jaws, larger anteriorly, those in the upper jaw directed horizontally backwards. Other bones edentulous. Tongue absent.

Gill-membranes united with isthmus. Gill-opening very small, reduced to an ovoid foramen, almost lateral. Gill-rakers 11, small, pointed. Anterior third of first gill-arch adnate to inner surface of operculum. Pseudobranchiae present. Branchiostegals 7.

D IV 8, commences above the gill-opening. Spines filamentous, 1st longest, equal to head, remainder decrease to the 4th which is 2 in head. Second dorsal separated from the first by a space equal to the length of the base of the first dorsal. Rays bifid, filamentous, 1st ray 3 in head, 2nd-4th slightly shorter, remainder increase to the last, which is twice the first.

A 7, commences below the base of the 3rd dorsal ray. Rays bifid, first about 3 in head, remainder increase to the last which is twice the first.

P 20, lanceolate, almost as long as head.

V I, 5, inserted below the first dorsal, as long as head. Bases moderately separated by a space less than half of the length of the fin. Last ray joined by a membrane to the pectoral base.

Caudal lanceolate, 1.4 times head. Peduncle $\frac{1}{3}$ as deep as long. The lateral line is continuous on to the head and across the nape, with branches on the head. The lateral line, from above the gill-opening, first curves sharply down towards the pectoral base, then in a gentle curve up towards the anterior dorsal rays, then down to the middle of the body, thereafter straight to the base of the caudal: there are above and below, small oblique branches opening each by a pore.

Colour: (Preserved) light brown, marbled and spotted with darker. Top of head dark. Upper ventral rays, tip of caudal and margins of dorsal and anal dusky.

Type in the Albany Museum.

A single male specimen, 148 mm. in length from Port Alfred.

This species is related to *lineolatus* (C. & V.), from the Indo-Pacific, but differs in having only one denticle on the preopercular spine.

Family SERRANIDAE.

Serranus knysnaensis Gilch.

1904, Gilchrist, Mar. Invest. S.A., vol. iii, p. 2, pl. XIX.

1925, Barnard, Ann. S.A. Mus. vol. xxi, p. 461.

Body moderately compressed. Dorsal profile flat, with slight prominence above eyes. Depth 3.3, length of head 2.8 in length of body. Eye 3.5 in head, 1.5 times interorbital width, slightly greater than snout, and 1.8 in the postorbital part of the head. Mouth large, lower jaw prominent, maxilla extends to almost below centre of eye. Small curved conical teeth in narrow bands in both jaws, on vomer and on palatines. Canines small, fewer and larger in lower jaw. Tongue edentate.

Preopercle serrate, serrae not enlarged at angle. Middle opercular spine largest. Preorbital shallow, 3 in eye. Gill-rakers 11, very slender, far apart, 1.5 in gill-filaments, which are 3 in eye.

D X 14, commences above hind margin of operculum: 1st spine shortest 6.3, 2nd 4.2, 3rd-5th subequal longest 2.4 in head. Remainder decrease to the last. No notch. Anterior rays almost 1.5 times last spine. Fin scaly.

A III 7, commences below base of last dorsal spine; 2nd spine as long as, but stouter than the third.

Pectoral rounded, 1.4 in head. Ventrals 1.5 in head, inserted behind pectorals, reach vent.

Caudal emarginate, peduncle longer than deep.

Scales stenoid. l.l. 71, l.tr. 7/19, l.l. tubes anteriorly with ascending branch. L.l. follows dorsal profile. 10 scales on cheek. Scaling on head extends to above eye.

Colour: (alive) Red-brown above, lighter below. Two dark brown longitudinal stripes, 2/3 width of eye, upper from eye just below lateral line along side to peduncle, thence over extending on to the base of the upper caudal lobe: lower from pectoral base to the base of lower caudal lobe. Two rust-red diagonal streaks

from preorbital down across cheek. A red blotch on the lower opercular margin. Red bars along lower jaw. Hind margin of caudal red, fin spotted with red. Pectoral reddish. Dorsal and anal suffused with red, with longitudinal series of darker red spots.

Length: 65 mm.

A single specimen taken at Knysna.

It is singular that no specimens of this species have been reported since its discovery in 1904 to the present, and the fish is not known to the oldest angling residents at Knysna. The absence of markings on the type is not remarkable, since the brilliant colouration of the live fish has practically disappeared with preservation, though the longitudinal stripes are still clearly visible.

Epinephelus flavocaeruleus Lac. [Pl. XXII, fig. A.]

1878, Day Fishes of India, p. 15, pl. iii, fig. I.

1925, Barnard, Ann. S.A. Museum, vol. XXI, p. 475.

Body compressed, dorsal profile, from snout to base of dorsal, undulate, convex above eyes. Depth 2.4, length of head 2.6 in length of body. Eye 4.3 in head, equal to snout and interorbital width. Preopercle margin serrate, serrae enlarged at angle, one large spine with 2 smaller below. Lower opercular spine further back than upper. Mouth oblique lower jaw projects, maxilla extends to below hind margin of pupil. Villiform teeth in posteriorly tapering bands in each jaw, canines small. A single series of teeth on side of mandible. Gill-rakers 15, longest as long as gill-filaments, which are 2.2 in eye.

D XI, 17, arises over hind margin of operculum, not notched. 1st spine, shortest, 5, 2nd 3.2, 3rd 3.0, 4th longest, 2.8 in length of head: remainder decrease slightly. Anterior rays longer than last spine, 3rd ray longest, 2.6 in head. Fin scaly.

A III 8, arises below base of 5th dorsal ray. 2nd and 3rd spines sub-equal, 2nd stoutest.

Pectorals rounded, 1.6 in head. Ventrals 1.8 in head, reach to vent.

Caudal truncate.

Scales on body ctenoid, cycloid on head and nape. l.l. 73 l.r. 137, 25 rows above l.l.

Colour: Body dull-blue from snout posteriorly to above end of base of anal, behind this bright yellow. Anterior portion of dorsal base dark blue, remainder of dorsal, whole of anal, of pectorals and all of ventrals, excepting dark distal third of 1st ray, bright yellow.

Length: 116 mm.

Locality: Port Alfred

Distribution: Indo-Pacific.

A juvenile specimen of this species, a rare migrant to the more southerly portions of the South African coast. The colour-pattern is most striking and vivid, with the bright canary-yellow peduncle and caudal.

Family HOPLEGNATHIDAE.

Hoplegnathus robinsoni Rgn. [Pl. XVIII, fig. C.]

1916, Regan, Ann. Durb. Mus. vol. i, pt. 3, p. 168.

1925, Barnard, Ann S.A. Mus. vol. XXI, p. 506.

Body ovate, very compressed, width 3.5-4 in depth. Depth 1.8-2, length of head 3 in length of body. Eye 3-4.2 in head, 1.1-1.3 in interorbital width.

Mouth terminal, moderate, lower jaw projects slightly. In the young the teeth are incisiform, closely set in a single row in each jaw. With growth the teeth become fused, with development of a flattened inner flange on the roof and floor of the mouth, bearing marginal tubercles. No other teeth. Maxilla extends to below the anterior border of the eye. Anterior nostril circular with a plain flap. Concealed spine on posterior margin of opercle, hind margin serrate in young. Preopercle ~~in young~~ serrate, serrae enlarged at angle. Gill-membranes more or less united, free from isthmus. Gill-rakers 16-17, slender, 2 in eye.

17-19

D XI, 21-22, originates above pectoral base, first spine shortest 8-10 in head, remainder increase rapidly to the 4th, and thereafter very gradually, last spine longest. The anterior soft rays are elevated, becoming sub-falcate in the adult, decrease

rapidly after the 7th, which in the adult is about as long as head. The base of the soft dorsal is slightly longer than that of the spinous portion of the fin.

A III, 14-16, third spine strongest. Anterior soft rays longest. Shape of fin resembles that of the dorsal.

P. 15-16, 1.8-2 in head, gently rounded.

V I, 5, without axillary process, 1.2-1.5 in head, reaches beyond origin of anal.

Caudal emarginate, peduncle as deep as long, about 3 in head. Scales strongly ctenoid, l.r. about 110, 30 above l.l. l.l. tubules 82-90. Interorbital naked except for a few scales along anterior border of eye.

Colour: (alive) Yellow, with 5 anteriorly convex black cross-bars, 1st through eye, 2nd from anterior dorsal spines through opercle and base of pectoral extending over the ventral; 3rd broadest, on middle of body extending on to dorsal and anal, 4th on hinder part of body, 5th narrow, on peduncle at base of caudal. Pectorals light. Caudal with dark margin, very marked in the adult.

Length: 32-185 mm.

Locality: Algoa Bay, Knysna, Natal.

This species has been known only from the type. Regan (loc. cit.) states that the interorbital of the type is scaly and that the middle dorsal spines are the longest. In my specimens the interorbital is scaleless, except for a few scales along the upper margin of the orbit, and the posterior dorsal spines are longest.

The genus *Scarostoma* (Kner) differs from the type genus in having the interorbital scaly and the spinous dorsal not more than 1.4 times as long as the soft portion of the fin. *Robinsoni* thus bridges the gap between these genera, and it would appear scarcely necessary to maintain *Scarostoma* as distinct.

Specimens of this species are rarely encountered and, as I have observed, anglers who secure any would be inclined to regard them as slightly abnormal specimens of *Diplodus cervinus* Lowe, which the present species resembles closely in shape and colouration.

Family CEPOLIDAE.

Acanthocephala cuneatus n. sp. [Pl. XXI, fig. A.]

Body very compressed, elongate, band-like, tapering posteriorly. Greatest depth across pectoral base. Profile gently sloping from nape, snout somewhat blunt and swollen. Muciferous pores and canals on head. Depth 6, length of head 6.7 in length of body. Eye 3.4 in head, 1.4 times snout and 1.1 times the interorbital width.

Six preopercular spines: largest spine at angle, 4 smaller on lower limb, anterior three below skin, one small spine above the angle below skin. Mouth moderate, very oblique, lower jaw projects. Maxilla excluded from upper jaw, extends to below the posterior third of the eye. Small conical teeth in a single row in the upper jaw. A single series of similar teeth on the sides of the lower jaw, with 2 short series of smaller teeth on a pair of symphyseal knobs, which latter fit into a corresponding recess in the upper jaw. Three pairs of dentigerous upper pharyngeals. Tongue rounded, free.

Nostrils double. Vent far forward, immediately before the base of the anal, below the base of the pectoral.

Gill-opening wide, gill-membranes free from isthmus. Gills 4, a slit behind the 4th. Gill-rakers 30, long and slender, slightly longer than gill-filaments, about 5 in head. Branchiostegals 6; pseudobranchiae present.

D 67, commences above the middle of the opercle. 1st ray shortest, about 5 in head, remainder increase to the middle, thereafter decrease somewhat in length. Middle rays about 1.6 in head. Rays indistinctly articulated.

A 74, commences below the base of the 6th dorsal ray. Anterior rays increase to the 12th which is about 2.3 in head, thereafter sub-equal. Articulations indistinct. Dorsal and anal confluent with caudal.

P 20, 1.7 in head, rays branched. A thickened fold of skin from the axil of the pectoral to the upper angle of the operculum.

V I 5, inserted slightly in advance of below the hinder margin of the preopercle, 1.4 in head. 1st ray filamentous,

reaches to the base of the 6th anal ray. Ventral bases united, last ray joined to the body by a membrane.

Scales cycloid, minute. Free margin of scales forming a right angled point. Scales on hinder portion of body slightly larger than those on anterior part. Lateral series about 285. Lateral line commences at the shoulder and runs obliquely up to the base of the 4th dorsal ray, thereafter along the base of the dorsal, finally curving abruptly down on to the base of the caudal. The lateral line scales are of curious shape, anteriorly ridged. (Pl. XXI, fig. A). A large scale with arborescent muciferous tubules above the upper angle of the operculum. Head naked, except cheeks, interopercle, and a small patch on upper anterior margin of opercle. Limb of preopercle naked. Mentum naked, transversely rugose. Five median scales before the base of the dorsal.

Colour: Red-brown. Fins light. Dark oval blotch between the 8th-14th dorsal rays.

Type: A single specimen, 262 mm. in length, from Natal, precise locality unknown, the specimen being among certain fishes obtained by the S.S. "Pickle," labelled "Natal fishes, unclassified," donated by the Government Fisheries Survey to the Albany Museum, 1931.

Barnard (Ann. S.A. Mus., 1925, vol. XXI, p. 503) included *Acanthocephala limbata* (C. & V) in the South African fauna list on the examination of a dried specimen from Delagoa Bay. It is not unlikely that this (*fide* Barnard, since lost) was identical with that here described, since both possess the blotch on the anterior dorsal spines. It must, however, be noted that Barnard (*loc. cit.*) admits *indica* Day to the synonymy of *limbata*, but states that the latter has no lateral line, whereas Day (Fishes of India, 1878, p. 796) states that *indica* has a lateral line on the anterior third of the body. The lateral line of the present species is certainly obscure, but nevertheless quite definite. More careful observation may show that the other species of this genus also possess complete lateral lines.

Cuneatus is very much deeper anteriorly, and the body tapers more rapidly, than is the case with the other species of the

family. This feature is so marked, that should the other species of *Acanthocephala* Blkr. be found to have incomplete lateral lines, generic distinction for *cuneatus* would appear justifiable.

Family LUTIANIDAE.

Caesio algoae n. sp.

Body compressed. Dorsal profile even, sharply concave over eye. Interorbital gently convex. Depth 2.7, length of head 3.5 in length of body. Eye 3.2 in head, 1.3 times snout and equal to the interorbital width. Posterior nostril slit-like. Preorbital depth 3.3 in eye. Maxilla narrow, almost concealed by preorbital, does not extend below anterior border of orbit. Small curved conical teeth in a single series in each jaw, none on vomer, palatines or tongue. A lanceolate space between the rami of the lower jaw, densely scaled to apex at symphysis. Head, excepting interorbital, snout and sides of lower jaw, densely scaled. Naked interorbital and snout densely pitted with minute pores. None of opercular bones serrate.

Branchiostegals 6, 4 scales on membrane between the 2nd and 3rd (anterior) rays, remainder of membrane naked. Gill-rakers 19, slender, 1.5 in gill-filaments which are 2 in eye. Pseudobranchiae present. Pyloric caeca 4.

D XI, 13, commences over the ventral base. 1st spine about 5 in head, 4th and 5th longest 2.5 in head, remainder decrease. Anterior rays slightly longer than last spine, decrease posteriorly. Membrane of soft dorsal basally scaly.

A III, 12, commences below the base of the 2nd dorsal ray, 1st spine short, 2nd stout, sub-equal in length to the 3rd which is 2.5 in head. Anterior rays slightly longer than 3rd spine, thereafter decrease slightly. Membrane of soft rays basally scaly.

P 17, falciform, as long as head. Base scaly. Ventrals inserted behind pectoral base, do not reach to vent. Caudal deeply emarginate, base densely scaled.

Scales strongly ctenoid, l.l. 72, l.tr. 9/16. 11 series on cheek.

Colour: Rosy above, silvery below. Occiput dusky. Black spot in axil of pectoral. Margin of dorsal dusky, remaining fins light.

A single mature male specimen, 200 mm. in length, from off Algoa Bay in 60 fms.

Type in the Albany Museum.

This specimen is very close to *axillaris* Blgr., from which it differs in having an extra ray in the dorsal and anal fins, in the greater number of lateral line scales and in the much narrower preorbital.

A revision of this genus will probably show that nominal species exist; wider collection may show the present species to fall within the limits of variation of *axillaris*.

Family CARANGIDAE.

Decapterus lajang Blkr. [Pl. XXI, fig. D.]

Body elongate, moderately compressed, width 1.3 in depth. Depth 6.3, length of head 3.8 in length of body. Eye 3.6 in head, 1.1 in snout, 1.5 in postorbital part of head and slightly greater than interorbital width. Snout sub-conical. Dorsal profile even. Interorbital gently convex, scaleless, with a medio-longitudinal ridge parallel with which on each side are several fine longitudinal grooves. Preorbital, depth almost two thirds of an eye-diameter, with radiating muciferous tubules, branching distally. Preopercle margin even, with radiating grooves and tubules. Opercular membrane not serrate. Mouth oblique, lower jaw projects. Maxilla expanded posteriorly, hind margin concave, extends to below the anterior margin of the orbit. Fine teeth in a single series in the lower jaw, in a longitudinal bi- or tri-serial band on tongue, and in a patch on each side of vomer. Palatines with a few minute rudimentary teeth in a single widely spaced series. No teeth in upper jaw. Adipose eyelids well developed, anterior and posterior united above and below, leaving an oval median opening almost as wide as pupil. Gill-rakers 36, slender, 1.2 in gill filaments, which are 1.5 in eye.

D I+VIII+1, 37+1, originates twice as far from base of caudal as from tip of snout. 1st spine minute, procumbent, directed forwards. 3rd spine of second dorsal longest, 2.1 in head, last spine very short. Anterior portion of soft dorsal elevated, falcate, 2nd ray longest, 2.5 in head: remainder decrease to the 8th, which

is 5.5 in head, thereafter sub-equal in length. The detached finlet is 4.6 in head, reaches beyond caudal base. Fin scaleless, with low scaly sheath, flanking fairly deep groove.

A II + 1, 28 + 1, originates below the 6th dorsal ray. First two spines separate, sub-equal, about 9 in head. Second anal similar in shape to soft dorsal, 2nd ray longest, 3 in head. Finlet as long as dorsal finlet, opposite which it is inserted.

P 22, falcate, 1.5 in head, shorter than head without snout.

V.I.5, 2.3 in head, bases narrowly separated, inserted below hind margin of pectoral base, 1st ray longest. Caudal forked, peduncle moderately depressed.

Scales very small, lateral line scales enlarged. Lateral line gently undulate, curves down from shoulder, up to below origin of soft dorsal, down to below 15th dorsal ray, thereafter straight. 94 scales from shoulder to below the 24th dorsal ray, then follow 29 spinose scutes which increase in size to the 14th—20th largest, height 2.5 in eye, thereafter decrease. 12 scales with tubules on caudal base. The tubes on the anterior (non-spinose) scales have a recurved branch above and below (Pl. IVa). 9 series of scales above lateral line below origin of dorsal. 2 series on cheek. Opercle naked.

Colour: Blue-green above, silvery below. A dusky spot on hind margin of operculum. Axil of pectoral black. Fins light.

Length: Up to 170 mm.

Locality: Knysna, (Durban).

Distribution: Indo-pacific.

This specimen is provisionally assigned to *lajang* Blkr., from most descriptions of which, however, it differs in certain particulars, notably in the more elongate body, in the relatively larger eye and in the shorter pectoral. The very feeble dentition of the fishes of this genus appears to be the feature upon which differentiation is mainly based. The palatine teeth in this specimen are so exceedingly feeble that their presence may be ascertained only with the greatest difficulty. It is not improbable that this specimen may prove to be the juvenile of *macrosoma* Blkr., to which *lajang* is very closely related.

The presence of any species of this genus as far South as Knysna is interesting. None of the netters to whom I showed the specimen could recollect having seen any other.

I have since found juveniles of this species very plentiful at Durban.

Family CHAETODONTIDAE.

Chaetodon marleyi Rgn. [Pl. XXII, fig. C.]

1921, Regan, Ann. Durb. Mus. III, pt. 1, p. 1.

1925, Fowler, Proc. Ac. Nat. Sci. Phil. LXXVII, p. 251.

1925, Barnard, Ann. S.A. Mus. XXI, p. 613.

Body ovate, very compressed. Dorsal profile steep from nape, slightly convex at nape, concave from occiput to snout. Depth 1.4-1.6, length of head 2.4-2.6 in length of body. Eye equal to snout, to postorbital part of head and to interorbital width, 3 in length of head.

Snout pointed, sub-conical. Mouth very small, maxilla extends to below anterior nostril.

D XI, 23-25, 1st spine almost antrorse, slightly shorter than eye. Remainder increase to the 4th and remain sub-equal. Soft rays anteriorly equal to last spines; gradually decrease.

A III 17-19, inserted below the base of the last dorsal spine.

Pectorals equal to ventrals 1.3-1.4 in head. Ventrals extend to or beyond vent.

Scales strongly ctenoid, l.l. 41-43, l.tr. $\frac{7}{23-26}$. The scale-rows above the lateral line run back and up. On the first third below the lateral line the rows run back and up. Those on the mid-posterior part of the body only are horizontal, the rows on the lower part of the body run back and slightly down. Five cheek scales. Whole of head and body scaly. Dorsal and anal densely scaled.

Colour: (Alive) Orange yellow, with scale centres slightly darker accentuating the scale rows. A dark median bar from nape to snout through interorbital. A dark curved band from nape through eye to isthmus, less than eye. A broader band from the 2nd-4th dorsal spines through pectoral base extending over ventrals and a similar band from the origin of the soft dorsal

to the anterior part of the soft anal. A dark bar across peduncle, and a lighter bar across the base of the caudal rays. A white-edged black ocellus on the 3rd-10th dorsal rays, about the size of the eye. Pectorals and unbarred part of the dorsal, anal and caudal, yellow. Ventrals with outer part black, inner yellow.

Length: 26-60 mm.

Locality: Knysna, Algoa Bay, Kariega and Kowie Rivers, Port St. Johns, Durban.

I have examined a number of specimens, but in none are any but a few mid-posterior portions of the scale-rows below the lateral-line horizontal. Nor have I seen any in which the ocellus covers the last dorsal spine, as stated by Barnard (loc. cit.)

This is the only South African species with 11 dorsal spines, a number which appears remarkably constant. This count, together with the brilliant and characteristic markings, enable this species to be distinguished at a glance.

It is singular to find a species of this genus commonly occurring so far south. It has been stated previously that at Knysna, in summer, it is not uncommon for very cold water to appear suddenly. The presence of *marleyi* in the river is an infallible sign that such an onset is imminent, and when the cold water actually enters the river, dead specimens of this species are usually thrown ashore.

Family RHACHICENTRIDAE.

Rhachycentrum canadus Linn.

"Sergeant fish" (Port Elizabeth). "Prodigal Son" (Natal). 1920, Robinson, Rep. Nat. Fish. 1919, p. 48 (*Elacate nigra*). 1925, Barnard, Ann. S.A. Mus. vol. XXI, p. 511.

Body elongate, very slightly compressed or sub-cylindrical. Dorsal profile even, almost horizontal. Head depressed, snout sharp.

Depth 6.5-7, length of head 4.7-5 in length of body. Eye about 7 in head, 2.5-3 in snout and 3-3.5 in interorbital width.

Interorbital slightly convex, skin rugose. Mouth large, terminal, slightly oblique, apparently fairly protractile. Villiform teeth in broad bands on jaws, vomer and palatines. Maxilla extends to below the anterior border of the eye. Lower jaw projects somewhat. Nostrils paired, close together, slightly nearer anterior margin of orbit than tip of snout.

D VIII+1, 31-32. Spines short and stout, sub-equal, 10 in length of head, widely spaced, connected to the body by a membrane, and depressible each in a separate groove. Anterior rays elevated, sub-falcate; 4th-6th rays longest, $\frac{3}{4}$ of the length of the head. Remainder decrease rapidly to the 9th and thereafter gradually to the last, which is about $\frac{1}{3}$ of the length of the 4th.

A II, 24-28. Spines small and fairly stout, enveloped in skin. Anterior soft rays elevated, sub-falcate, 2nd-4th longest, about half the length of the head. Shape of soft fin similar to that of the soft dorsal.

P 20-21, sub-falcate, slightly shorter than head.

V I, 5, less than half the length of the pectoral; inserted below the middle of the base of the pectoral.

Caudal deeply emarginate, almost lunate. Peduncle moderately slender, $1\frac{1}{2}$ times as long as deep.

Scales: Very small. Lateral line single, almost straight. Cheek scaly.

Colour: Dark above, lighter below. Fins dark.

Length: Up to 1115 mm.

Locality: Algoa Bay.

The above description is based upon three stuffed specimens in the Port Elizabeth Museum.

Barnard (loc. cit.) queries the validity of Robinson's record (loc. cit.) of the above species in Natal waters, which query he bases upon the possibility of confusion of the generic names *Elacate* and *Elagatis*. Further, *Elagatis bipinnulatus* (Q & G) is stated by Barnard to have the colloquial name "Prodigal Son."

Apart from this, it does not appear likely that the present species could be confused with *E. bipinnulatus* (Q & G), since the two differ markedly in shape and in external features.

This species is an occasional capture in Algoa Bay.

Family PLECTORHYNCHIDAE.

Pomadasys operculare (Plyfr.)

"Knoorhaan" (Port Beaufort to Keurbooms River), "Tiger" (Eastern Province), "Spotted grunter" (East London to Natal).

1866, Playfair & Gunther, Fish. Zanz. p. 24, Pl. 24, fig. I.

1888, Day, Fish India, p. 76.

1925, Fowler, Proc. Acad. Nat. Sci. Philad. vol. LXXVII, p. 231.

1925, Barnard, Ann. S. African Mus. vol. XXI, p. 675.

Body moderately compressed. Dorsal profile even, concave above eyes, with a nuchal prominence, increasing with age.

Depth 3.3-3.6, length of head 3-3.1 in length of body. Eye 6.9-7.2 in length of head, 2.8-3 in snout and 1.8-2 in interorbital width. Postorbital part of the head 2.2 in length of head. Snout sub-conical, slightly depressed.

Mouth small, terminal, slightly oblique. Maxilla extends to below midway between the tip of the snout and the anterior border of the eye. Maxilla almost concealed beneath preorbital. Villiform teeth in bands in both jaws; other bones edentulous.

Rudimentary, but distinct, adipose eyelids, more evident in larger examples. Preorbital naked, almost twice as long as deep. Nostrils close together just before the orbit, anterior oval, posterior circular or ovoid.

Whole of head, except preorbital, chin, and snout in advance of anterior nostril, scaly.

Preopercle denticulate, with two large flat blunted projections at the angle: hinder margin of limb concave. No obvious opercular spines. An enlarged scale above the opercle on the shoulder. Gill-rakers 15-16, moderate, 3 in length of the gill-filaments, which are sub-equal to eye. Branchiostegals, 7.

D. X-XI, 13-16. (commonest count XI, 14) deeply notched, commences vertically above or slightly behind the base of the pectoral. Spines depressible in a deep groove. First spine short, about half an eye diameter. Second twice the first, third and fourth sub-equal about 3 in head. Remaining spines decrease to

the last. The anterior soft rays are somewhat elevated, the first and second longest, sub-equal in length to the sixth dorsal spine. Remainder decrease in length.

A III, 8-10. (commonest count III, 9.) commences below the base of the third dorsal ray. Fin depressible in a deep groove. First spine very short and stout; second longest and very stout; third spine slightly shorter and much less stout than second. First soft ray longest, fifth shortest, the edge of the fin being slightly concave.

P 18-19, falcate, about equal to the head, reaches to above the base of the anal. Basal membrane slightly scaly. Large rounded scaly process in axil. V I, 5, inserted below the dorsal origin, 1.9 in length of head, membrane scaly.

Caudal deeply emarginate, upper lobe usually slightly the larger, densely scaled; peduncle longer than deep.

Scales: ctenoid on body, cycloid on head. l.l. 51-61, gently curved, extends on to the caudal. l.tr. $\frac{9-10}{18-20}$. About ten series on the cheek, and seven series on the operculum. Two series of scales on sheath below dorsal spines, four below soft dorsal and anal.

Colour: (Alive) Bright silvery, slightly bronzy above. About 190 dark spots on side above the level of the base of the pectoral, those below the lateral line occasionally in undulating rows. A black axillary spot. Dark blotch on hinder margin of operculum. A black triangular mark before the base of each dorsal ray: a similar mark before the apex of each dorsal spine. Membrane of ventral and anterior membrane of anal dusky. Caudal light, with a narrow dark posterior margin. Remaining fins light.

Length: Up to 770 mm.

Locality: All tidal rivers from Breede River, Port Beaufort to Natal.

The above description is based upon the examination of over a hundred fresh adult specimens, taken in various rivers, and ranging from 400-770 mm. in length. Of these, one only had D X, 16, and was evidently abnormal.

Previous descriptions appear to have been based upon immature specimens, and to have been none too accurate.

Barnard (loc. cit.) does not accept records of this species from anywhere east of East London, and suggests confusion with *bennetti* (Lows). *Operculare* is abundant in all tidal rivers as far west as the Knysna and the Brak Rivers, and is well known in the tidal portion of the Breede River, Port Beaufort.

Operculare Plyfr. is closely related to *P. suillum* (C & V), from the tropical west coast of Africa. The two species have hitherto been maintained as distinct on the difference between the dorsal and anal fin formulae, and on the scale counts. The former species is now shown to fall within the limits for the variation in the fin formulae of the latter. In regard to scale counts, unless the precise limits are stated, it is possible, in the case of *operculare* at least, to record wide variation. The lateral line extends on to the caudal, as many as seven scales bearing tubules being found beyond the base of the fin. Further, in the transverse series, three different counts are possible, and may be taken: 1. series from in advance of the dorsal fin; 2. series from below the spinous dorsal including the sheath scales; 3. the same count not including the sheath scales, which are very small.

For *suillum* (C & V), the usual count as given is l.tr. $\frac{9}{15-17}$ while Pellegrin (Poiss, eux d ouc. l'Afr. occ. p. 257) gives $\frac{6-7}{14-15}$. This latter count was most likely taken after the manner of 3. above.

I have not been able to secure a specimen of *suillum*, which is not represented in collections in South Africa, nor in that of the British Museum. Nevertheless, the evidence here adduced renders it most unlikely that *operculare* Plyfr. can be maintained as distinct from *suillum* (C & V), as previously suspected by Day (loc. cit.).

P. operculare ranks high among the estuarine game fishes of South Africa. It is extremely vigorous, and being rather shy and wily, is a much-prized capture. Specimens weighing 16 lbs. have been recorded, though any above 10 lbs. are rare.

It appears to feed chiefly on crustacea, as well as upon the small creatures which inhabit the mud and sand banks of estuaries. These latter the "Tiger" is believed to secure by forcing

its pig-like snout into the mud, and blowing them from their holes. The tails of these fishes may frequently be seen in estuaries waving above the surface of the water on shallow banks. This habit is shared by *Pagellus lithognathus* (C & V), the "White steenbras."

The name "Grunter," applied to most of the species of this genus, arises from the sounds which most of them emit after capture. It is generally stated that these sounds are produced by contractions of the air-bladder. In *operculare* and *bennetti* Lowe at least this is not the case. The sounds are produced by the rasping together of the upper and lower dentigerous pharyngeals.

Day (loc. cit.) states that the flesh of these fishes is not highly esteemed in India. This is remarkable, since in South Africa *operculare* is rightly considered one of the most delicate food-fishes.

Family SPARIDAE.

Pagrus nasutus Cast. [Pl. XXIII, fig. B.]

Body compressed, width 3 in depth. Dorsal profile from nape slightly concave above eye, with a moderate preorbital prominence.

Depth 2.2, length of head 2.7 in length of body. Eye 3.6 in head, 1.3 in snout, 1.6 in postorbital part of head, equal to interorbital width and 1.4 times depth of preorbital. Preorbital longer than deep. Posterior nostril oval, almost as large as anterior. Mouth fairly large, moderately oblique, maxilla extends to below the anterior margin of the eye.

Four canines in upper, 6 in lower jaw, the smaller teeth in the sides of the jaws variable in size. Gill-rakers 11, short and stout.

D XII, 10, notched between spinous and soft portions. First spine 6, 4th longest, 2.5, last spine 3.3 in head. Soft rays higher than spines, edge of soft dorsal rounded. The whole fin may be contained in a deep groove with a scaly sheath.

A III, 8, inserted below the first dorsal ray. Second spine longest and stoutest. Soft rays higher than spines, edge of fin rounded. Fin with deep scaly sheath.

Pectoral almost as long as head, base scaly.

Ventrals 1.6 in head, reach to vent.

Caudal forked, base densely scaled.

Scales ctenoid; those above the lateral-line much smaller than those below. l.l. 61, l.tr. 10/20. Limb of preopercle scaly. 14 series on cheek. 10 series on sheath below soft dorsal. Scaling on head extends to above the posterior nostril.

Colour: Red-brown, with irregular lighter nebulous patches, largest over nape. Ventrals, axil of pectoral, and anterior soft rays of dorsal and anal black. Snout and nape dusky. Iris bronzy.

Length: 140 mm.

Locality: Port Alfred.

It is with difficulty that this species may be recognised in so small a specimen, since there are numerous differences from the familiar form of the adult. The dentition alone is misleading, for the lateral molars are acute, and do not differ appreciably in form from the lateral teeth of some species of *Dentex* Cuv. In fact, for some time I considered this specimen to fall in that genus, but somewhat larger examples recently secured leave no doubt of its identity.

It may be noted that Fowler (Bull. U.S. Nat. Mus., 1933, vol. 12, p. 145 ff.) has united under *Sparus* Linn. the species of *Sparus* and those placed by Barnard (*loc. cit.* p. 692-704) in *Pagrus* Cuv. There are numerous objections to Fowler's diagnosis, and in my opinion these two groups are not congeneric.

Family AMPHIPRIONIDAE.

Dascyllus axillaris n. sp. [Pl. XXII, fig. D.]

Dorsal profile even, with a moderately prominent inter-orbital bulge. Body ovate deep, compressed.

Depth 1.6, length of head 3.4 in length of body. Eye 2.3 in head, 1.2 times interorbital width, and 1.8 times snout. Pre-orbital 3 in eye diameter.

Maxilla extends to below the anterior third of the eye, and is almost concealed beneath the preorbital. Mouth small, oblique, moderately protractile. Villiform teeth in bands in both jaws, the outer row enlarged, conical; other bones edentulous. Opercle

not serrate: two flat spines on upper hinder margin, the lower more acute. Preopercle, sub- and pre-orbitals serrate. Suborbital with free lower margin. Preorbital slightly longer than deep.

Gill-rakers 13 on lower limb of the anterior arch, slender, 2 in length of the gill-filaments, which are 4.5 in the length of the head. Branchiostegals 5, concealed.

D XII, 16, commences above the hind margin of the operculum. 1st spine short, 2.3 in head. 2nd and 3rd spines longest, sub-equal, about 1.2 in head. Remainder decrease to the last, which is 1.5 in head. The first soft ray is slightly longer than the last dorsal spine. The rays increase in length to the fifth and sixth, and thereafter decrease rapidly to the last, which is shorter than the first dorsal spine. The fin is scarcely notched, and the soft rays have a highly convex margin. Both spinous and soft dorsal scaly.

A II, 14, commences below the base of the last dorsal spine. First spine short, sub-equal to but stouter than the first dorsal spine. Second spine three times the length of the first. Soft rays longer than the spines, the shape of the fin resembling that of the soft dorsal. Anal rays densely scaled.

P 20, sub-equal to head, basal portion lightly scaled.

V I, 5, inserted below the anterior margin of the base of the pectoral, reach to base of the 1st anal spine. The ventrals have a pointed axillary scale and an enlarged pointed scale between the bases. Caudal sub-truncate or very slightly emarginate, basal portion scaly.

Scales: ctenoid, large. Lat. series 28, l.tr. $\frac{4}{10}$. Two lateral lines, tubules $\frac{10}{5}$. The upper lateral line follows the dorsal profile and ceases below the base of the 6th dorsal ray. The lower lateral line, which runs along the middle of the peduncle, consists of 5 tubules and several rudimentary canals on bordering scales. The whole of the head is scaly. The scales on the snout, interorbital and nape are small. 3 or 4 vertical series of scales on cheek, 5 horizontal series on opercle.

Colour: Uniform red-brown. Ventrals and anal spines black. Margin of soft dorsal and anal, apices of dorsal interspinous

membrane and the whole of the caudal, dusky. Pectorals light. A black spot in the axil of the pectoral.

A single specimen 87 mm. in length, from Great Fish Point. *Type* in the Albany Museum.

The South African species of this genus are not well known, and the three hitherto admitted are distinguished chiefly by the colouration.

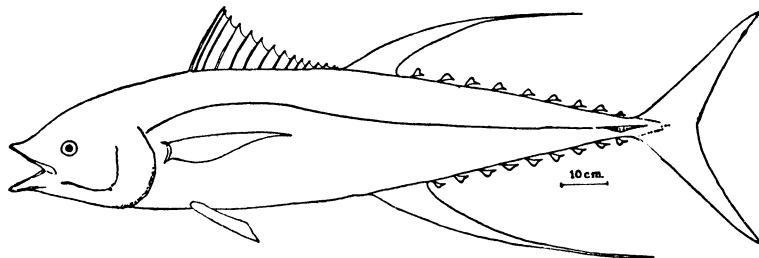
The present species differs from these in this character, chiefly in the presence of the marked axillary spot, as well as in the scale counts, fin formulae and shape of the anterior portion of the dorsal fin. The scaly membrane of the spinous dorsal is most likely a generic feature, but does not appear to have been mentioned in descriptions of species of this genus.

Since specimens are but rarely seen, and most of the descriptions based on but a single specimen, it is not unlikely that a revision of adequate material would result in a very severe limitation of the number of species in this genus.

Family SCOMBRIDAE.

Neothunnus itosibi J. & E. [Text fig. 4.]

1926, Jordan & Evermann, Occ. Papers. Cal. Ac. Sci. XII, p. 22, pl. 6.



Text fig. 4. *Neothunnus itosibi* J. & E.

Body fusiform, scarcely compressed, as wide as deep. Depth 5.0, length of head 3.9 in length of body. Eye 12 in head, 4.6 in snout and in interorbital width, 7 in the postorbital part of the head. Maxilla extends to below the anterior margin of the eye.

D XV, 14+9. originates behind the base of the pectoral. Anterior spines highest, 1.8 in head, decrease rapidly to the last which is about $1/6$ of the length of the first. Anterior soft rays very elongate, filamentous, 2.4 in length of body, reach to caudal base. 9 detached finlets small, sub-equal. Interspinous membrane scarcely incised.

A II, 12+9, originates below the 14th dorsal ray, shape similar to that of dorsal, filamentous rays 2.2 in length of body, reach beyond caudal base. Finlets 9.

P 32, sub-falcate, reaches almost to base of soft dorsal (probably longer, but tips broken in specimen).

Ventrals inserted below dorsal origin.

Entire body scaly, scaling forming a corselet anteriorly. Lateral line gently curved anteriorly, following dorsal profile.

Caudal lunate, peduncle very slender, with a single large lateral keel.

Colour: Silvery brown below, darker above. Head and spinous dorsal dark.

Length: 1650 mm.

Locality: Algoa Bay.

Distribution: Pacific (Japan).

This remarkable specimen was taken on rod and line from the Port Elizabeth breakwater in June, 1932. A school of these fishes suddenly appeared, but only the specimen captured would take any of the baits offered, the effective lure being a whole "Elft" (*Pomatomus saltator* Linn).

A very large fish was taken in a net in the Knysna lagoon shortly after the capture of the Algoa Bay specimen. It had unfortunately been cut up and eaten before I heard of it, but from descriptions was undoubtedly conspecific with the Algoa Bay specimen, and may have been a straggler from the main school. Those who were concerned in the capture of the Knysna specimen stated that it appeared to be affected in some way though no external injury was apparent. Another specimen was encountered at sea by a fishing-boat from Knysna.

The critical internal diagnostic features of the stuffed Algoa Bay specimen had unfortunately not been preserved, and the

absolute identity of the specimen must to some extent remain uncertain, but I have provisionally assigned it to *itosibi*, with the somewhat meagre description of which the external features agree fairly closely, except that the latter species has 8 anal finlets, whereas this specimen has 9.

Its presence in our waters is very remarkable, but is in line with the roving habits of the *Scombridae*.

Fowler (Proc. Ac. Nat. Sci. Phil. 1933, vol. LXXXV, p. 163, Pl. 12) has described a new genus, *Semathunnus*, differentiated from *Neothunnus* by the greater length of the dorsal and anal lobes. This appears a rather slender basis for generic distinction and will scarcely prove acceptable. It is not unlikely that the various species of *Neothunnus* (and of *Semathunnus*?) will ultimately all be found to be identical: one single circumtropical form.

Family TEUTHIDIDAE.

Monoceros unicornis Forsk.

1931, Smith. Rec. Alb. Mus. IV, p. 145, fig. (*Prionolepis hewitti*.)

The small type of *P. hewitti* was placed in the Grammicolepidae largely on account of the grammicolepid type of scaling. A slightly larger specimen, obviously conspecific, has since been found, in which developmental changes make it obvious that the above was a mal-identification, and that the specimens are most likely the juvenile forms of *unicornis* Forsk.

These very interesting juveniles are at present being investigated, chiefly in regard to the squamation, and full details of this and of the specimens will be published later.

Family PLATACIDAE.

Tripteron orbis Plyfr.

1866, Playfair and Gunther, Fish Zanz. p. 42, fig.

1909, Gilchrist and Thompson, Ann. S.A. Mus. VI. p. 228
(*Chaetodipterus faber non* Brouss.)

1917, Gilchrist and Thompson, Ann. Durb. Mus. I, p. 367
(*ibid*).

1922, Norman, Ann. Mag. Nat. Hist. (9), IX, p. 321
(*Chaetodipterus orbis* Bl.).

1925, Fowler, Proc. Ac. Nat. Sci. Phil. LXXVII, p. 242.

1925, Barnard, Ann. S.A. Mus. XXI, p. 603 (*Chaetodipterus
goreensis* non C & V): and p. 604 (*Chaetodipterus
orbis* non Bloch): and p. 725 (*T. Orbis*.)

The above synonymy has resulted from the examination of the specimens in the South African Museum: all of these are clearly conspecific with *Tripterodon orbis*, Plyfr., and *Chaetodipterus* Lac. is thus shown not to occur in South Africa. Dr. Barnard, of the S.A. Museum, is in agreement with this finding.

Norman's record (*loc. cit.*) of *C. orbis* Bloch from South Africa was due to a confusion of entries in the Register of the British Museum. Barnard had accepted Norman's record.

This little-known species is of great interest, since its systematic position is as yet undetermined. It is at present provisionally placed in the Platacidae.

A special study of this species is now in progress and the full text will be published later.

Family SCOMBRIDAE.

Scomberomorus lineolatus C & V.

1925, Barnard, Ann. S.A. Museum, XXI, p. 803.

Depth slightly more than length of head. Eye 6.5, snout 3.2, interorbital 3.2, postorbital 1.9 in length of head. Body moderately compressed, snout fairly pointed. Maxilla extends to below the hind margin of the pupil. A single row of compressed acutely triangular teeth in a single row in each jaw. Very fine teeth in patches on vomer, palatines and pterygoids. Branchiostegals 6.

D XVI, 17+?, Spines slender, separated.

A II, 16+?, inserted below the middle of the soft dorsal. Soft dorsal and anal anteriorly elevated, sub-falcate. Pectoral 1.9, ventrals 4 in head.

The lateral line runs slightly downwards, somewhat undulate in parts, to the middle of the side below the anterior finlets.

Colour: Deep blue above, silvery below. 3-4 series of longitudinally elongated dusky spots below the dark dorsal area. Pectoral, soft dorsal and tip of anal dusky.

Length: About 400 mm.

Locality: Port Alfred.

A damaged specimen, with the body severed behind the 3rd dorsal finlet, thrown up on the shore near Port Alfred. The remainder leaves no doubt as to the identity with *lineolatus* C & V.

This species is fairly common, at certain seasons, in Natal waters where it is known as "Snoek."

This is the first record from this area, though it may be noted that the related, but larger, species *commersoni* Lac is well known at Algoa Bay.

Family BLENNIIDAE.

Blennius cornutus (Linn.).

1908, Gilchrist and Thompson, Ann. S.A. Mus. vol. VI, pt. 2, p. 103 (*scullyi*).

1916, Gilchrist, Mar. Bio. Rep., vol. III, p. 11.

1918, Thompson (*ibid*), vol. IV, p. 145 (*cornutus*), p. 145 (*scullyi*).

1925, Barnard, Ann. S.A. Mus. vol. XXI, p. 833 (*cornutus*), p. 836 (*scullyi*).

According to the descriptions of *cornutus* and of *scullyi*, the latter species differs from the former in the presence of a dark spot between the 1st and 2nd dorsal spines, and in the shorter supraorbital tentacles. An examination of the type and co-types of *scullyi*, and a comparison of these with material recently collected from the Cape to Natal, show that these supposedly specific characters are inconstant and unreliable, there being complete gradation from the one form to the other. The dorsal spot is present in all specimens (*cornutus* or *scullyi*) that I have examined, but is relatively obscure in large examples, and tends to disappear in preserved material. There is no sharp line of division in the length of the supraorbital tentacles in a

series of either sex. In the Blenniidae, the variable markings are scarcely of specific value.

Blennius bifilum Gnthr. [Pl. XX, fig. C.]

1861, Gunther, Cat. Fish. Brit. Mus. vol. III, pp. 225, 261.

1917, Gilchrist and Thompson, Ann. Durb. Mus. vol. i, pt. 4, p. 414.

1923, von Bonde, Fish Mar. Surv. Spec. Rep. i, p. 34, pl. III, fig. I (*Salaria sexfasciatus*).

1925, Barnard, Ann. S.A. Mus. vol. XXI, p. 833 (*bifilum*); and p. 845 (*Salaria sexfasciatus*).

Body moderately compressed. Profile of head abruptly descending, snout very blunt.

Depth 5, length of head $4-4\frac{1}{2}$ in length of body. Eye 3.2-4 in head, $1-1\frac{1}{2}$ times snout and 1.6-2.2 times interorbital width. A simple tapering nasal tentacle about 9 in length of head. A pair of slender simple tapering tentacles on the nape, about 3 in head. No tentacles above eye. Mouth moderate, maxilla extends to below the anterior third of eye. A single row of incisors in each jaw, no canines visible. Gill-membranes united forming a fold across the throat.

D XI, 17-18, commences above midway between the hinder margins of the opercle and the preopercle, moderately to deeply notched (juv.). Anterior spines about 3 in head. Middle rays sub-equal to anterior spines. Last ray joined to peduncle at base of caudal.

A II, 18, commences below the base of the last dorsal spine. Spines small and feeble, soft rays longer. P. 15, rounded, equal to head.

V I, 2, inserted below the hinder margin of the preopercle, slightly less than head. Caudal lanceolate, slightly longer than head.

Lateral line obscure, consisting of a single row of tubules on the anterior third of the body.

Colour: Brown, with six dark wide cross-bars extending on to the dorsal.

A dark bar across the pectoral base and a dark spot on the base of the middle pectoral rays. Two dark bars across the throat, of which the hinder bifurcates, with posterior limbs extending on to the ventral bases. Two dark marks on opercle and a black spot below and behind eye. Caudal spotted, other fins light.

Three specimens, 30 mm. in length up, from St. Lucia Lake, presented by W. Bell-Marley, Esq.

Distribution: East Coast of Africa.

The markings on the smallest specimen (figured) are very vivid, the gular bars being especially marked. These cross-bars and the blotches on the pectoral are much fainter in the larger specimens, and have disappeared on preservation in alcohol.

I have examined specimens of *bifilum* in the S.A. Museum and find distinct traces of these markings, which do not appear to have been noticed previously.

I have not been able to examine the type of *S. sexfasciatus* vB., but the somewhat meagre description and the figure (*loc. cit.*) are in close agreement with the diagnosis of *bifilum*, and with the specimens of this latter species that I have examined. The pearly spots on the body of *sexfasciatus* are also present in some specimens of *bifilum*, and there is one in the S.A. Museum with the spots corresponding with those shown in the figure of *sexfasciatus*.

It may be indicated that the young of various species of *Blennius* (Linn.) have somewhat movable teeth, especially those in the lower jaw, but never to the same extent as the teeth of species of *Salarias*. Barnard (*loc. cit.*, p. 845) was evidently doubtful of the validity of *sexfasciatus*.

Petroscirtes tapeinosoma Blkr. [Pl. XXI, fig. B.]

1877, Gunther, Mus. Godeffroy, Journ. vol. 6, pt. II, p. 195, pl. 115, fig. D.

1906, Seale, B.P. Bishop Mus. Occ. Papers vol. 4, no I, p. 89.

1928, Fowler, Fishes Oceania, Mem B.P. Bish. Mus. vol X, p. 430.

Body elongate, compressed. Depth 8.5, length of head 5.6 in length of body. Eye 3.1 in head, slightly greater than snout and than interorbital, 1.6 in postorbital part of the head. Snout pointed, dorsal profile gently sloping, dorsally depressed, projects half eye diameter beyond anterior margin of upper jaw. Mouth inferior, cleft extends to almost below centre of eye; teeth in a single immovable series in each jaw, a very large curved canine on each side in lower jaw. No tentacles. Gill-openings reduced, about half eye diameter.

D 46, commences slightly in advance of gill-opening, anterior rays shortest, increase posteriorly last rays shorter, fin ends near caudal base. Longest rays 1.5 times eye.

A 31, commences below the 17th dorsal ray, ends near caudal base. Longest rays 1.3 times eye.

P. 12, 1.8 in head.

V 3, thoracic, reduced, middle ray longest, 3 in head.

Caudal forked.

Colour: (Alive) Indigo-blue above, light blue below. A fine light blue longitudinal stripe from hind margin of eye, following dorsal profile. A wide dark blue lateral stripe, from snout and head, divided by 16 narrow light blue cross-bars tapering on peduncle and continued on the middle of the caudal. Head to lower edge of pupil indigo-blue; a narrow light blue stripe from lower margin of snout to pectoral base, bordered below by a fine darker line. Mouth, lower part of snout, throat, ventrals and caudal bright orange. Anal blue-black with light margin. Dorsal with broad blue-black marginal band. Pectoral yellow.

A single specimen, 80 mm. in length, from Great Fish Point, thrown up by the waves, together with innumerable live specimens of *Champsodon capensis* Rgn., during a storm.

Distribution: Red Sea, Indo-Pacific.

The colour pattern of the live fish is exceedingly beautiful and vivid.

This is the first record of this species from South Africa. It is remarkable that it has not previously been discovered in the tropical portion of our East Coast region.

Family GOBIIDAE.

Psammogobius n.g.

Differs from *Gobius* Art. only in the very wide and unrestricted gill-opening, the membranes being completely free from the isthmus. The ventrals are elongate, reaching to the base of the anal or beyond. Genotype *knysnaensis* n. sp.

In view of the prolific suggested sub-genera of *Gobius*, the introduction of a new genus closely allied to *Gobius* may not appear very desirable, but the character of the gill-opening in *Psammogobius* merits the institution of the genus.

Psammogobius knysnaensis n. sp.

Body cylindrical, scarcely compressed posteriorly. Head not very broad, scarcely depressed. Depth 5-5.5, length of head 3.3-3.5 in length of body. Eye 3.3-3.6 in head, and sub-equal to snout. Interorbital very narrow, eyes almost contiguous, dorso-lateral.

Mouth moderate, oblique, lower jaw projects strongly. Maxilla extends to below the anterior margin of the eye. Teeth fine, pointed, conical, recurved and depressible, in 3-4 series in each jaw, inner series largest. No large canines. Tongue bilobed, free.

Muciferous pores on head; 2-3 horizontal series of papillae on cheek. Anterior nostril tubular. Gill-opening wide, membranes completely free from isthmus. Gill-rakers short and stout, anterior club-shaped, 7-8 on the lower part of the anterior arch. Branchiostegals 4. Pseudobranchiae reduced, not obvious. No shoulder flaps.

D VI+I, 9, commences vertically above the middle of the pectoral, the two fins clearly separated. The spinous dorsal is not elevated, the anterior spines are about $\frac{3}{4}$ of the depth of the body. Spines scarcely project beyond the membrane. The soft rays are slightly higher than the anterior spines.

A I, 10. Rays about half of the depth of the body.

P 17-18, rounded, no free rays, almost $\frac{3}{4}$ of the length of the head.

Ventrals not adnate to belly, very long, reaching to or beyond the origin of the anal.

Caudal rounded, about $\frac{2}{3}$ of the length of the head.

Scales ctenoid. Lat. series 29-31. trans. series 9-10. Scaling on head extends to vertically above midway between the hinder margins of the opercle and preopercle. 10-12 median series of scales before the base of the dorsal. Head otherwise naked. A small patch of cycloid scales on the throat immediately before the base of the ventrals, one large median scale, the others smaller, scarcely visible, obscured by a thick coat of mucus.

Colour: Grey-brown, mottled and streaked. 5 irregular cross-bars. 6-7 vertical fine white cross-bars on the lower part of the side (rarely absent). Dorsal and anal with rows of spots. In some males a bright green ocellus between the 4th-6th dorsal spines.

Types from Knysna in the Albany Museum.

Length: Up to 61 mm.

The above description is based upon a number of specimens ranging from 25-61 mm. in length, collected in the tidal portions of the Breede, Knysna, Keurbooms, Bushmans and Kowie Rivers.

This species lives on the sand banks in these rivers. The colouration harmonises well with the surroundings, and the species is able to bury itself in the sand with extraordinary rapidity. On the sand banks, these small fishes advance with the tide, resting in the fringes of the tiny ripples; when startled, they dart away a short distance, and easily sink below the surface of the sand, when they may be secured by scooping up the sand. Specimens are frequently left stranded by the tide, but appear to suffer no inconvenience, remaining buried in the moist sand until the water returns.

The white transverse streaks found on the majority of specimens are very characteristic, and apart from the obvious character of the unrestricted gill-opening, serve to distinguish at a glance this species from the numerous species of *Gobius* Art.

Family CLINIDAE.

Clinus heterodon C. & V. [Pl. XXII, fig. F.]1908, Gilchrist and Thompson, Ann S.A. Mus. vol. VI, p. 136
(*graminis*).

1925, Barnard, Ann. S.A. Mus. vol. XXI, p. 863.

Body fairly compressed, deepest at vent. Depth 3.4-3.6, length of head 4 in length of body. Eye equal to snout 5.6-6, interorbital 7-7.5, and postorbital 1.7 in length of head. Snout moderately pointed, sub-conical. Maxilla extends to below the anterior margin of the orbit or slightly further. A single row of fairly stout blunt conical teeth in the outer margin of each jaw. A double patch of smaller similar teeth behind the outer teeth at the front of each jaw. A single chevron-shaped row across vomer. Gill-membranes united, forming a pronounced fold across the throat. No tentacle over the eye.

D XXXIII, 5 (or III+XXX, 5) inserted above the hind margin of the preopercle. First 3 spines elevated forming a low crest, 2nd spine longest 2.3 in head. 4th spine shortest equal to eye. Remainder increase gradually to the ante-penultimate. Penultimate and last spine somewhat abruptly graduated longer, last spine equal to second spine of crest. All spines with a single cirrus at apex, largest on crest. Soft rays abruptly longer than spines, membrane joined to peduncle.

A II 22-23, inserted below the 13-15th dorsal spine. P 12, rounded, ventrals I, 3, last ray small but distinct. Caudal sub-truncate.

Scales cycloid, small, but larger than in most other species of this genus, clearly imbricated. Lateral line distinct to peduncle.

Colour: Brilliant and variable. Yellowish to almost black, with vermiculations and mottlings in bronzy and red tints. A darkish wavy band on body below dorsal, traces of cross blotches in some specimens.

Length: Up to 136 mm.

Localities: Bushman's River mouth; Great Fish Point; St. Lucia Bay, Zululand.

A somewhat rare species, only recently discovered in the Eastern Province. Its occurrence as far north as Zululand is especially remarkable.

Venustis G & T and *taurus* G & T have also been obtained recently at Knysna, and *robustus* G & T, at East London.

Clinus laurentii. G & T.

1908, Gilchrist & Thompson, Ann. S.A. Mus., vol. vi, pt. 2, p. 120.

1917, *ibid* Ann. Durban Mus. vol. i, pt. 4, p. 414.

1925, Barnard, Ann. S.A. Mus., vol. xxi, p. 866 (*Petraites* L.).

Body moderately compressed. Dorsal profile even, gently sloping to snout, slightly convex before eyes. Depth 4.2, length of head 4 in length of body. Eye 5 in head, 1.4 in snout and twice interorbital width. Snout pointed, moderately depressed. Mouth moderate, slightly oblique, lower jaw projects, lips thick. Maxilla extends to below the anterior third of eye. Villiform teeth in bands in both jaws, outer series enlarged. A single band of curved teeth on vomer. A simple flap over the anterior nostril. No supraorbital tentacles. Gill-membranes united forming a fold across the throat. Gill-rakers reduced, 5 on lower limb of the anterior arch.

D III, XXVII, 5, commences slightly in advance of the hinder margin of the preopercle. The first three spines form a crest, separated by a deep notch from the rest of the fin; 4th spine almost free from the membrane from the 3rd spine. 1st and 2nd spines sub-equal, almost half of the length of the head, 3rd spine 3.5 in head. 4th spine shortest, 6 in head. Remaining spines increase to the last, which is twice as long as the 4th. Anterior soft rays elevated, 1st ray sub-equal in length to the 1st dorsal spine, remainder decrease slightly. Last ray joined by a membrane to the peduncle near the base of the caudal.

A II, 21, commences below the base of the 15th dorsal spine. Spines stout, second longer. Anterior soft rays longer than the spines, 2.6 in head; remainder increase to the 19th, last ray short, not joined to the peduncle.

P 12, rounded, 1.3 in length of head. V I, 3, half length of head inner ray small but stout.

Caudal slightly rounded, half of the length of the head.

Scales very small. Lateral line descends abruptly over the end of the pectoral, complete to peduncle, tubules simple.

Colour: (preserved) Light brown-yellow with traces of darker mottling.

A single specimen 150 mm. in length, from Port St. Johns.

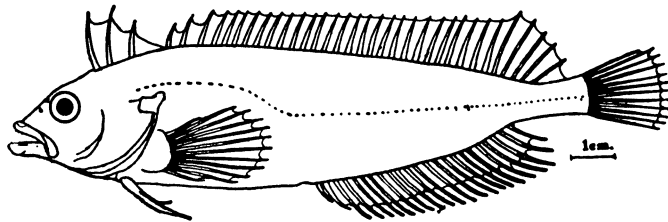
Barnard (loc. cit.) has separated *laurentii* G & T, together with *argentatus* Risso and *mentalis* G & T from the other species of *Clinus* Cuv., and has placed them in the genus *Petraites* Ogilby. This genus resembles *Clinus* in all respects save that the anterior crest of the dorsal is separate from the rest of the fin.

In the Clinidae, the character of the highly developed dorsal fin has served as a basis for generic sub-division, but the partial application accepted by Barnard is scarcely justifiable. It may be pointed out that the South African species of *Clinus* appear to fall into certain well defined groups; for example, *anguillaris* C & V and *striatus* G & T are closely related, and differ so markedly in general features from other groups of closely allied species, such as *supercilioxus* Linn., *ornatus* G. & T and *laurentii* G & T, as to render generic distinction from these at least as sound as that of *laurentii* from *supercilioxus*. In regard to the latter species, I find that the further East specimens are obtained, the higher is the dorsal crest, and the lower, on the average, is the point of attachment of the membrane from the third to the fourth dorsal spine.

Certain specimens of *supercilioxus* in the Albany Museum, collected from Great Fish Point to the Transkei coast, have the dorsal crest as high as the length of the head, while the membrane from the 3rd dorsal spine barely reaches the base of the 4th. So marked is the division in the dorsal fin, that, barring the presence or absence of orbital tentacles, there can be no doubt that *supercilioxus* and *laurentii* should be placed together in the same genus.

The generic sub-division of *Clinus*, based largely upon the character of the dorsal fin, is widely accepted, and the South

African species of this genus may possibly with advantage so be divided.



Text fig. 5. *Clinus laurentii* G & T.

Family BROTLIDAE.

Brotula palmietensis n. sp. [Pl. XXI, fig. C.]

Body elongate, compressed, tapering posteriorly. Snout rounded, blunt, profile gently sloping from nape. Depth 6.4, length of head 5 in length of body. Eye 3.6 in head, 1.7 times snout and 2.5 times interorbital width. Preopercle without free margin, covered by skin. A sharp spine on the opercle. Nostrils double. Mouth moderate, lower jaw shorter, included in upper. Maxilla extends to below the hind margin of the eye. A single row of fine conical teeth in both jaws, those in the lower slightly larger: other bones edentulous. Three pairs of mandibular barbels, sub-equal, about 10 in head. Two pairs maxillary and one pair nasal barbels; outer maxillary barbels longest, about 7 in head. Gill-membranes free from isthmus. Gills 4, a slit behind the 4th. Gill-rakers reduced to mere knobs, 6-7 on the lower part of the anterior arch. Pseudobranchiae absent.

D ca 100, commences over the middle of the pectoral, rays sub-equal.

A ca 80, commences below the middle of the body. Dorsal and anal confluent with caudal, which is pointed.

P 24, slightly less than head; rays simple.

V 2, reduced, inserted slightly in advance of below the hind margin of the preopercle, slightly more than half of the length of the head. Inner ray short, adnate to outer filamentous ray.

Scales cycloid, very small. l.l. ca. 80, curves up over the pectoral, then slightly down and thereafter runs obliquely towards the upper margin of the base of the caudal. 8 scales above and 16 below lateral line. Head naked except for a wedge-shaped area on occiput with apex over the middle of eye, merging behind into the general scaling.

Colour: Silvery-brown, with numerous fine spots. Abdominal area and preopercle densely spotted. Snout and nape dusky. Fins light. Dorsal and anal with a small spot at the base of each ray, and with a dusky spotted border.

Type in the Albany Museum.

A single specimen, 50 mm. in length, almost certainly juvenile, from Great Fish Point, taken in a rock pool. This is the first record of a species of this genus from South Africa.

Family STROMATEIDAE.

Psenes whiteleggii Waite. [Pl. XIX. fig. A.]

1902, Regan. Ann. Mag. Nat. Hist. (7), vol. X, p. 126.

Body ovate, very compressed. Profile of head deeply concave at interorbital, abruptly descending before eyes. Depth 2.4, length of head 2.4 in length of body. Eye 2.7 in head, 1.6 times snout and 1.3 times interorbital width. Bones of head not serrate. Two flat ill-defined spines at upper hinder margin of operculum. Lateral line on head freely branched.

Mouth small, terminal, oblique. Maxilla extends to below the anterior third of the eye, almost entirely concealed beneath the preorbital. A single row of minute curved conical teeth in each jaw, other bones and tongue edentulous. Nostrils ovoid, large. Gill-membranes free from isthmus. Gill-rakers 16, moderate, slightly shorter than the gill-filaments, 10 in length of head. Pseudobranchiae present.

D XI-I, 20, commences above the middle of the opercle, deeply notched, 1st XI spines form an almost separate fin. 1st spine short, 3rd-5th longest, almost 2 in head, remainder decrease to the 10th and 11th, which are small, 12th spine abruptly longer.

Soft rays higher than the last spine, slightly shorter than the 4th spine, decrease slightly posteriorly.

A III, 19, commences below the base of the last dorsal spine. 1st spine very small, remainder increase. Soft rays sub-equal, slightly longer than 3 in head.

P 20, rounded, 1.6 in length of head.

V I, 5, inserted below the middle of the base of the pectoral, 1.6 in length of head, reach to the base of the 2nd anal spine. Last ray joined to body by membrane.

Caudal deeply forked.

Scales thin, cycloid, moderate, rather deciduous. Lateral line 60-63, gently curved following dorsal profile, slight downward bend on peduncle: tubules simple, 4-5 series of scales above lateral line, those below mostly shed.

Colour: Light silvery-brown, darker above, nape dusky. Dendritic spots over most of the body and fins. Ventrals, caudal lobes, first dorsal, margins of pectorals, 2nd dorsal and anal dusky. Pectorals immaculate. The spots are denser in 3 areas on the body giving the impression of three faint cross bands, the first very wide, from head almost to vent, the second below the middle of the soft dorsal and the last on the peduncle.

Distribution: South-east coast of Africa: Australia.

A single specimen 30 mm. in length from Great Fish Point. A shoal of juvenile specimens was found in a rock-pool after a violent storm at sea, but owing to a mishap, all except this one specimen were lost.

In the members of this family growth changes occur in the body and fins. This little specimen at first sight resembles *Cubiceps natalensis* (G & vB), but the absence of lingual and vomerine teeth, the highly compressed body and the position of the rather elongate ventrals leave no doubt that it falls in the genus *Psenes* (C & V). Minor differences from *whiteleggi* exist, but they are scarcely of specific significance.

The discovery of this Australian species on our coasts is interesting.

A specimen 42 mm. in length has since been found at the Bushman's River (near Port Alfred).

Family SCORPAENIDAE.

Coccotropus jubatus n. sp. [Pl. XVIII, fig. B.]

Body compressed. Dorsal profile even to eye, sharply concave before eye. Snout very blunt, abruptly descending. Depth 2.7, length of head 2.8 in length of body. Eye 5.2 in head, 1.4 in snout, and slightly greater than interorbital width. Head armoured. 2nd suborbital produced across cheek. Preorbital produced into 2 recurved spines, the larger above. 4 flat spines on the preopercle, the lower 3 each with a fleshy papilla above. 3 opercular spines, slender, below the skin. Mucous pores and granulations on head.

Lower nostril tubular; upper circular, small, scarcely larger than a mucous pore. Mouth small, terminal, slightly oblique. Lower jaw projects slightly. Maxilla extends to below anterior quarter of eye. Supra-maxilla present. Villiform teeth in bands in both jaws and on vomer. Other bones edentulous. Gills $3\frac{1}{2}$. Gill-rakers 7, reduced to mere knobs. Pseudobranchiae absent. Gill-membranes free from isthmus. Gill-opening wide. Branchiostegals 3.

D XVI, 8, commences over anterior border of the eye. Anterior spines elevated forming a crest. 1st spine shortest about 5, 2nd 1.6, 3rd 1.4, in length of head. 4th spine sub-equal to 2nd, the remainder decrease to the 7th, remain equal to the 9th, while 10th-16th are sub-equal, and slightly longer than the 9th. The soft rays are simple, and increase in length posteriorly: the last ray is abruptly shortest and is joined to the peduncle at the base of the caudal.

A II, 7. Commences below the base of the 12th dorsal spine. Spines short, curved, moderately stout. 1st anal spine 6, 2nd, 4 in length of head. Rays longer than the spines, the last not joined to the base of the caudal.

P 9, rays simple, almost as long as head, reaches to vent.

V I, 2, very oblique, bases moderately separated. Inserted slightly in advance of pectorals. Spine almost half length of head, rays simple, inner ray half length of spine, joined for $\frac{2}{3}$ of its length by a membrane to the belly.

Caudal 13. Pointed, as long as head. Peduncle as deep as long.

Scales absent. Head rugose. l.l. tubules 13, extend to peduncle.

Colour: Brown with traces of darker marbling. Streaks on head, one from interorbital through eye to margin of preopercle. Fins light.

Type: A single specimen 57 mm. in length from Natal, precise locality unknown, the specimen being among certain fishes obtained by the S.S. "Pickle," labelled "Natal fishes, unclassified," donated by the Director of the Government Fisheries Survey to the Albany Museum.

The systematic position of this specimen is somewhat doubtful. In some respects it would appear closely related to the *Aploactidae*, or at any rate midway between this family and the *Scorpaenidae*. Since I had not sufficient material or literature to enable me to decide this point, I sent the specimen to Mr. Norman of the British Museum, who considers that it is a *Scorpaenid*, probably falling in *Coccotropus* Kaup. I am provisionally accepting this diagnosis, although the elevated anterior portion of the dorsal does not appear to be characteristic of this genus.

Family SCORPAENIDAE.

Scorpaena kowiensis. n. sp.

Body very slightly compressed. Snout moderately pointed, slightly depressed. Depth 2.7, length of head 2.5 in length of body. Eye 3 in head, equal to snout and twice interorbital width. Head ridged and spinose. 2 flat spines on operculum; a large spine at angle of preopercle, 4 small spines below. 3 preorbital spines, one pointing forward, the other two downward and backward over the maxilla. 3 small postorbital, 3 temporal, 3 supraorbital, one nasal and two suprascapular spines. Spinose suborbital ridge. A flat spine on shoulder girdle above axil of pectoral. Interorbital concave with a slight medio-longitudinal ridge. No supraorbital tentacles. No skinny flaps on head or body.

Mouth moderate. Maxilla extends to below the anterior third of the eye. Villiform teeth in both jaws in bands, which are wider anteriorly. Villiform teeth on vomer and on anterior portion of palatines. Gill-openings wide, membranes free from isthmus. Gill-rakers reduced, 5, short and stout, plus four rudiments, on lower limb of anterior arch. Pseudobranchiae present. Branchiostegals 7.

D XII, 9, deeply notched, commences over the base of the pectoral, in advance of the hind margin of the opercle. 1st spine short, remainder increase to the 4th, which is 3 in head: thereafter decrease to the 11th, which is shorter than the 1st. The last spine is abruptly longer than the 11th. Soft rays higher than the spines.

A III, 5, commences below the base of the 2nd dorsal ray. 1st spine short, 2nd longest, 2 in head. Soft rays longer than the spines.

P 15, rounded, 1.5 in head. 10 lower rays simple, upper 5 branched. V I, 5, bases close together. Inner ray short, connected for half its length by a membrane to the belly.

Caudal 22, rounded.

Scales ctenoid, moderate. Lateral series of scales 39, tubules 24, 1| | |
| --- | --- |
| tr. | $\frac{7}{25}$ |
. Head naked, indications of rudimentary scales below skin.

Colour: Red-brown, head and nape darker, mottled and spotted. Pectorals and dorsal brownish, spotted. Dark bar across the base of the caudal. Other fins light.

Type in the Albany Museum.

A single specimen, 59 mm. in length, from Port Alfred.

This species is closely allied to *haplodactylus* (Blkr.) which has been recorded from Natal (Gilchrist and Thompson, Ann. Durb. Mus. 1917, vol. I, p. 408), but specimens from South African waters have apparently not been described.

Kowiensis differs from *haplodactylus* chiefly in having only 10 simple pectoral rays, and in the absence of supraorbital tentacles and of skinny flaps on the body.

Family PLATYCEPHALIDAE.

Platycephalus indicus (Linn.). [Pl. XX, fig. D.]

"Vlei stok-vis" (Knysna).

1878, Day, Fishes of India, p. 276 (*P. insidator*, Forsk.)

1925, Fowler, Proc. Ac. Nat. Sci. Phil. vol. LXXVII, p. 255.

1925, Barnard, Ann. S.A. Mus. vol. XXI, p. 932.

Body elongate, very depressed. Depth 11, length of head 3.7 in length of body. Eye 7.4 in head, 2.2 in snout, and 1.2 in interorbital width. Width of head at level of base of preopercle spines 1.3 in length. Head very depressed, ridged, ridges mostly smooth. Interorbital concave. A small blunted spine before the inner margin of the eye. Postorbital longitudinal ridge with two small spines, anterior an eye diameter behind eye, posterior midway between hind margins of eye and operculum. Two preopercular spines, upper gently curved, 2 in eye, lower slightly longer, straight. One opercular spine, blunt and feeble. Two suprascapular spines, lower strong. A naked skinny flap on opercular membrane below preopercular spines. Nostrils circular. No tentacles. A sub-triangular flap of the iris extends over half the pupil from inner margin. Maxilla extends to below middle of eye, lower jaw projects strongly. A band of villiform teeth, widening abruptly anteriorly in upper jaw, 2-3 anterior teeth on each side much enlarged. A single series of small conical teeth in lower jaw: a curved row on vomer single anteriorly, multiple posteriorly with enlarged inner teeth. A single series of curved conical teeth on palatines. Tongue edentate free.

Gill membranes free, rakers 6 plus 4 or 5 rudiments. Pyloric caeca 9.

D I+VII+I+12-13, originates 2.3 times as far from base of caudal as from tip of snout. 1st spine short, 15 in head. Second dorsal elevated, 1st and 2nd spines 2.0, 3rd 2.5, last 13 in head, membrane scarcely incised.

Behind the second dorsal is a small recumbent spine. Soft rays anteriorly elevated, 1st and 2nd longest, 2.4 in head, remainder graduated, 12th 4.0, last 7.5 in head. Membrane deeply incised between rays.

A 12-13, inserted below origin of soft dorsal. 1st and last rays sub-equal, 5 in head; rays increase to the 5th and remain sub-equal to the penultimate. Membrane deeply incised between rays.

P 18, more or less rounded, 6th ray longest, 2 in head. Tips of lower five rays free from membrane.

V I, 5, inserted below 1st dorsal spine, last (inner) ray longest 1.5 in head.

Caudal sub-truncate, peduncle moderately depressed.

Scales strongly ctenoid, 8 radiating striae; lateral line smooth. l.l. 128, 12 rows above.

Colour: Yellow-brown above and on sides, with very faint darker cross-bars, white below. Dark spots on lower side of head and on opercular membrane. Dorsal spines and rays spotted or annulate. Membrane light. Pectorals and ventrals brown, marbled and spotted with darker. Caudal dark below, middle and upper parts yellow, with large black spots above.

Length: Up to 670 mm.

Locality: Knysna, Port Elizabeth, Port Alfred.

Distribution: South and East Coast of Africa to Indo-pacific.

The numerous synonyms of *indicus* would appear to indicate that it is an exceedingly variable species.

Barnard (loc. cit.) states that the ridges on the head are quite smooth. Day (loc. cit.) mentions the small spine above the eye. The two specimens here described have two small but distinct recumbent spines on each postorbital ridge, besides the supra-orbital spine. Fowler (loc. cit.) states that his specimens have l.l. 76 or 77; such wide variation is scarcely possible, and the statement is possibly erroneous.

The iridal flap is conspicuously triangular in shape. Day (loc. cit. p. 274) states that there are two, a superior and an inferior flap, both semi-circular. There is no inferior flap in my specimens.

It is an open question whether our specimens merit specific distinction from those of the Indo-pacific, but a comparison of

specimens from both localities would be necessary to justify such a step.

Indicus is not an infrequent capture at Knysna, and a fish taken in the Breede River, Port Beaufort, described to me by a netter, was probably this species. At Knysna it is not infrequently taken also on lines, but it is regarded locally as inedible. The name "Vlei-stokvis" is derived from the shape of the posterior portion of the body and the tail, which resembles somewhat those of the "Stok-vis," (*Merluccius capensis* Cast.)

Family MONACANTHIDAE.

Monacanthus setifer Benn. [Pl. XIX, fig. B.]

1925, Barnard, Ann. S.A. Mus., vol. XXI, p. 955.

Body very compressed, back concave between the dorsals. Depth (back to lower margin of ventral flap) 1.5-1.8, or (origin of dorsal to origin of anal) 1.6-1.8, length of head 2.8-3.0 in body. Eye 3.4-3.7 in head, 2.4-2.8 in snout and 1.0-1.2 in the inter-orbital width. Gill-opening oblique, slightly less than an eye diameter, posterior margin slightly behind eye, in a straight line with hind margin of eye and origin of dorsal spine. Profile of snout steep, gently concave. Scales papilliform, with stellate apical dilation, causing skin to feel rather rough.

D 1 + 31-32. Spine stout, 1.6-1.7 in head, rough in front, with 2 rows of barbs behind, originates above hind margin of pupil. Soft dorsal low, inserted at highest point of dorsal profile, rays increase to the 4th, which is 2.7 in head, remain sub-equal to the 16th-18th and thereafter decrease somewhat.

A 33-35, originates below the 5th dorsal ray, slightly lower than dorsal but of similar shape.

P 14-15, 2.6 in head. Ventral spine movable.

Caudal 12, rounded, peduncle slightly longer than eye.

Colour: (Alive) Greenish brown, uniform, or with obscure longitudinal series of dark blotches. Dorsal, anal and pectoral yellow-brown. Caudal uniform brown-green, sometimes dusky posteriorly.

Length: 94-195 mm.

Locality: Knysna, Port Alfred, Great Fish Point.

These specimens are provisionally assigned to *setifer* Benn., from which however they may prove to be distinct. The species in this family are known to exhibit sexual dimorphism (Ebina, J. Imp. Fish. Inst. Tokyo, 1932, XXVII, p. 15) and are in general somewhat variable.

The present specimens would appear to differ from the typical form of *setifer* in the greater number of anal rays, in the anteriorly low soft dorsal, as well as in this latter fin being inserted at distinctly the highest point of the dorsal profile. Day (Fishes of India, 1888, p. 692) states that *setifer* has the dorsal spine inserted above the posterior part of the eye, which is the highest point of the dorsal profile; and that there are 12 rays in the pectoral and 9 in the caudal. There is a small specimen (65 mm.) in the S.A. Museum, in which the spinous and soft dorsal are on the same level, but all other South African specimens I have seen have the soft dorsal on a higher level than the spine, P 14-15 and C 12. Further, our specimens have not the two dark cross-bars on the caudal, and the body is deeper than is usually the case in *setifer*.

None of our specimens have the filamentous dorsal ray (1st. Barnard; 2nd Day) occasionally observed in *setifer*.

Individually, these differences would scarcely justify the separation of our specimens from *setifer*, but collectively they would indicate that it might be justifiable.

Setifer is only occasionally found at Knysna, but is fairly common eastwards from Port Elizabeth.

Family TETRODONTIDAE.

Tetrodon lagocephalus Linn. [Pl. XX, fig. A.]

1925, Barnard, Ann. S.A. Mus. vol. XXI, p. 966.

Body elongate, fairly compressed. Depth (uninflated) 3.8, length of head 3.8 in length of body. Eye 5.8 in head, 2.5 in snout, 2.3 in interorbital and in post-orbital part of head.

Belly from below middle of snout to vent with fixed 4-rooted spines: skin otherwise naked and smooth. Head less than distance from origin of dorsal. Lateral cutaneous fold distinct,

more obvious posteriorly. A small longitudinal fold of skin on upper part of peduncle. Nostrils paired, flush with surface. Mucus canals on head distinct. Whole of interorbital bony, expanded laterally over eye.

D 13, originates about midway between base of caudal and tip of pectoral, falcate, 2 in head. Base raised, lobate. Last ray joined to body by membrane.

A 13, arises slightly behind dorsal, same size and shape as dorsal.

P 15, scarcely falcate, 1.7 in head, lower four rays abruptly shorter. Caudal emarginate, posterior margin undulate, lobes pointed, lower 1.2 times upper.

Colour: Indigo-blue above, light blue below. Spinose belly almost white. A series of small black spots along side. Dorsal and caudal dark blue-black. Anal light, posterior margin dusky. Pectoral blue-black above, lower four rays light with dusky margin. A dusky blotch behind vent, behind anal and on lower part of peduncle.

Length: 550 mm.

Locality: Knysna River.

Distribution: Atlantic, Mediterranean, South African seas to Natal.

Barnard (loc. cit.) considers that the specimen somewhat scantily described by Fowler (Proc. Ac. Nat. Sci. Phil. 1925, vol. LXXVII, p. 267) as *stellatus* Schn. may possibly be *lagocephalus*. Fowler states definitely that almost the whole body is minutely spinulose, and that the caudal is convex behind. *Stellatus* is generally accepted (also by Barnard) as a synonym of *aerostaticus* Jenyns, and Fowler's specimen is very likely this latter species, although this author does not mention the presence of the characteristic black ring round the vent.

Lagocephalus is evidently a very rare visitor at Knysna, for the specimen described was shown to many local netters and line fishermen, but none could recollect having previously seen another.

Family OSTRACIONTIDAE.

Lactophrys quadricornis (Will.). [Pl. XXII, fig. B.]

1865, Bleeker, Atl. Ich. V, p. 32.

Depth 3, head 6.5 in total length. Preorbital depth equal to head, 3 times eye. Carapace three-angled, dorsal ridge acute, without spine. A stout spine, directed backwards, on each ventral ridge, below the dorsal fin. A conical spine, as long as eye, before each eye. The carapace forms a continuous bridge across the caudal peduncle behind the dorsal, terminating in an oblique median spine above, pointed below, laterally deeply concave. Interorbital deeply concave. Anterior opening of carapace slightly less than eye.

D 10, rays branched. A 10, inserted behind dorsal, rays branched. P 11, base almost horizontal, rays branched. Caudal 4 in total length, rays much branched, peduncle free, $\frac{2}{3}$ length of head. Whole body granular, with fused margins of hexagonal scutes naked.

Colour: Light brown, rows of dark spots on upper part of side. Four longitudinal bars on snout and cheek. Fins light, spotted.

Length: 290 mm.

Locality: Algoa Bay, (Cape of Good Hope, Bleeker).

Distribution: Tropical Atlantic, Indian Ocean.

A single specimen only, in the Port Elizabeth Museum.

This species must be a very rare migrant, for it has not been recorded from South Africa since 1865 (Bleeker *loc. cit.*)

Lactophrys gibbosus Linn.

1888, Day, Fishes of India, p. 695, Pl. CLXXXI, fig. 4,
(*Ostracion turritus*).

Body 3-ridged. Dorsal ridge sharp, elevated into a strong, slightly recurved, compressed spine, much higher than dorsal fin. At the anterior end of each supraorbital ridge is a fairly strong recurved compressed spine, projecting slightly outwards. On each ventro-lateral ridge are 4 compressed recurved spines, the

anterior just behind the pectoral, the posterior below the middle of the dorsal.

Height of body 2, length of head 3.5 in length to caudal base.

Eye 2.6, preorbital depth 1.7 in length of head. Median cross-section of body, exclusive of ridges, an equilateral triangle. Interorbital deeply concave.

Carapace forms a continuous bridge above and below peduncle, pointed (60°) above, rounded below.

D.9, A.9, former inserted well in advance of latter. P 11, almost vertical. Caudal rounded, 1.4 in head.

Colour: Brownish, with numerous round blue spots, mostly one in each scute.

Length: 195 mm.

Locality: Durban.

Distribution: East coast of Africa to the Indo-Malayan area. New York (*vide* Day *loc. cit*) ?

This is the first record of the above species from South Africa.

It is a little difficult to understand why *Lactophrys* Swnsn. has been accepted by many systematists as different from *Ostracion*, whereas *Lactoria* has not. The species of *Lactophrys* that I have examined all show distinct traces of the two dorso-lateral ridges clearly present in *Ostracion* (s.s).

Whichever of the 3 forms (i.e. carapace 3-, 4- or 5-angled) be selected as typical, the remaining two are clearly minor variations only, and seem scarcely to merit full generic distinction.

Family BALISTIDAE.

Balistes conspicillum Blch.

1888, Day, Fishes of India, p. 689.

1903, Jordan & Fowler, Proc. U.S. Nat. Mus., vol. 25, p. 256
(*Pachynathus* c.)

Depth about 2, length of head 3 in length of body. Eye 4 in snout, 5.5 in head.

A marked groove before eye: enlarged scutes behind gill-opening. Mouth set in naked ring round end of snout and chin.

D.III+26, inserted behind eye, above gill-opening. First spine very stout, 1.4 in head, uniformly granulate anteriorly. A 23, inserted well behind dorsal.

42 series of scales. Lateral line curves up from the shoulder then down below the soft dorsal origin. About 33 transverse series of scales between the soft dorsal and the vent. Cheek scales smaller than body scales. Each scale on mid-hinder part of body and tail with a retrorse spine: anteriorly there are 8-9 rows with small spines, graduated posteriorly to 2-3 rows with much larger spines on the peduncle.

Colour: Brownish, a light band across the snout before the eyes, originating each side below the anterior margin of the eye. A more or less triangular light patch below the cheek. 18-20 light round-oval patches along the lower half of the side. A narrow light ring round the mouth.

Length: 190 mm.

Locality: Presumably Port Alfred, having been found among other more common species from this locality, in the old collection of the Albany Museum.

Distribution: Indo-pacific.

I have since been informed by Mr. Chubb, Director of the Durban Museum, that he possesses a specimen of this species from Durban Bay.

Family ONCHOCEPHALIDAE.

Halieutea fitzsimonsi G. & T. [Pl. XXIII, fig. B.]

1916, Gilchrist & Thompson, Mar. Bio. Rep., p. 58, fig. (*Halieutichthys* f.)

1921, Regan, Ann. Mag. Nat. Hist. (9) VII, p. 419 (*liogaster*).

1922, Gilchrist, Fish. Mar. Survey. Spec. Rep. III, p. 79 (*liogaster*).

1923, von Bonde *ibid*, Spec. Rep. 1, p. 36 (*liogaster*).

1925, Barnard, Ann. S.A. Mus. XXI, p. 1009 (*Halieutichthys* f.) and p. 1010 (*liogaster*).

The type of this species is in the Port Elizabeth Museum. The original description gives the length as 158 mm. The actual

specimen I examined is 188 mm. in length, but the difference is probably due to typographical error, not uncommon in the earlier descriptions of South African fishes. There are also only four anal rays and not nine, as given by Gilchrist and Thompson, which is probably a similar error.

The markings described by the original authors, while somewhat faded, may clearly be discerned in the type. Two other specimens from Algoa Bay, and another from East London, are clearly conspecific with the type of *fitzsimonsi*, the two pairs of rings, one dark and one light, being very obvious in fresh specimens.

It is however singular that none of the four specimens examined have any trace of vomerine or of palatine teeth, while gill-rakers are present in each case, being clearly visible on distension of the oral cavity. There are, however, two pairs of dentigerous upper pharyngeals, which are placed rather far forward, owing to the distortion of the usual positions of the bones of the palate by longitudinal compression, such as is found in fishes of this type. It is possible that Gilchrist and Thompson mistook these pharyngeal for palatal teeth, although their orientation in regard to a similar pair of lower dentigerous pharyngeals immediately reveals their true nature.

The gill-rakers are short and stout, apically dilated, 6 on the lower limb of the anterior arch.

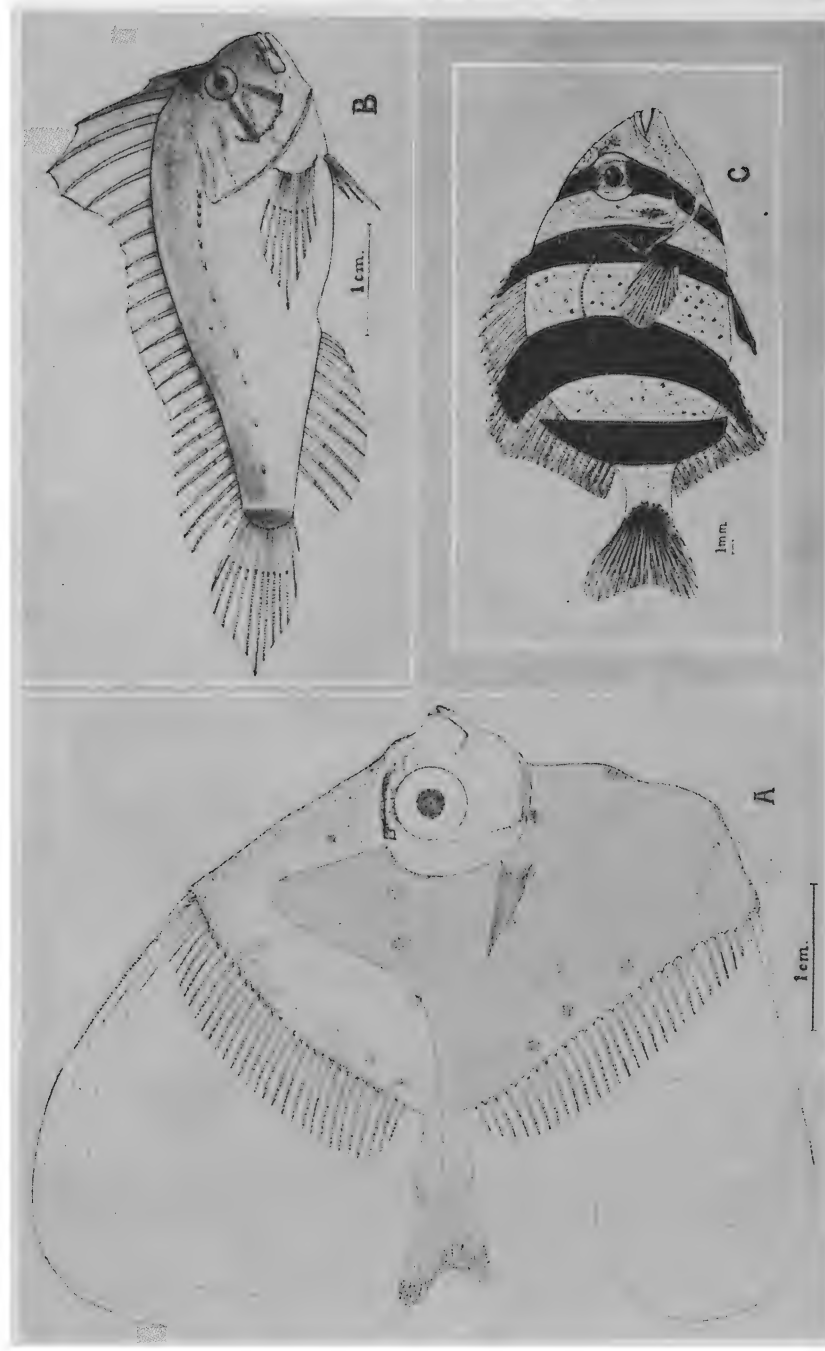
This species thus falls in the genus *Halieutea* C & V, which is distinguished from the related genus *Halientichthys* Poey by the absence of palatal teeth, and by the presence of gill-rakers. It may be remarked that Barnard (loc. cit.) was quite evidently doubtful of the validity of G & T's diagnosis, for the latter genus is found in the West Indies.

A comparison of these specimens with *liogaster* Rgn shows that it is not necessary to maintain the latter as distinct, since the two dark post-orbital spots of *fitzsimonsi* represent the only difference. One specimen of *liogaster* in the S.A. Museum has a dark post-orbital spot on one side only. The spots tend to disappear in preserved specimens.

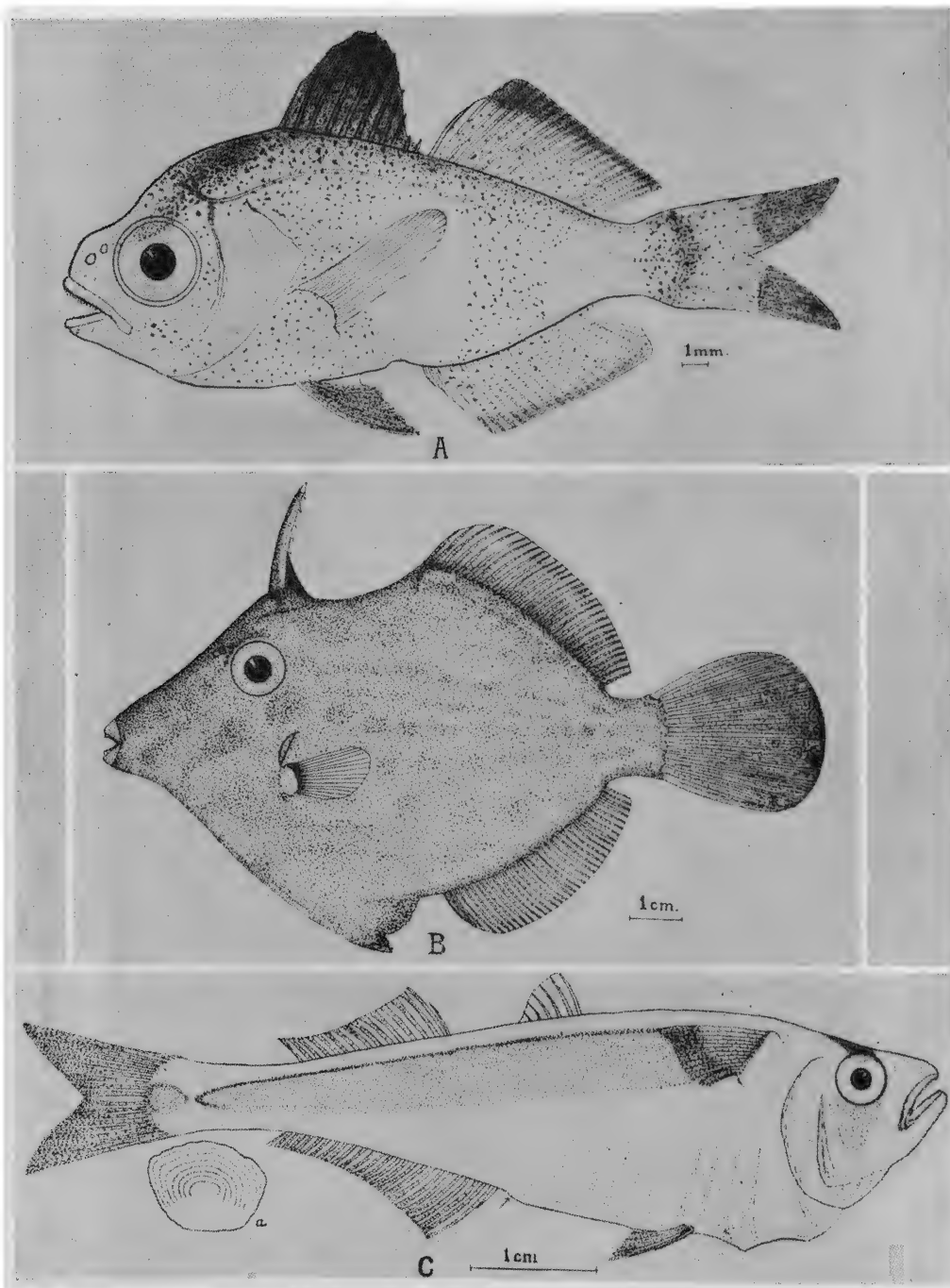
One of the larger specimens has two tentacles on the anterior margin of the depression containing the gill-opening. The outer is trifold, the inner simple. The lower surface of the live fish is coral-red, but the colour fades rapidly on preservation.

I wish to express my indebtedness to Dr. Barnard, Assistant Director of the S.A. Museum for assistance, and for the loan of material and literature: to Mr. J. Hewitt, Director of the Albany Museum, whose wide and unfailing knowledge is ever available and invaluable: and to the Carnegie Fund (through the Research Grant Board of South Africa) for generous financial assistance.

Albany Museum,
Grahamstown,
March, 1934.

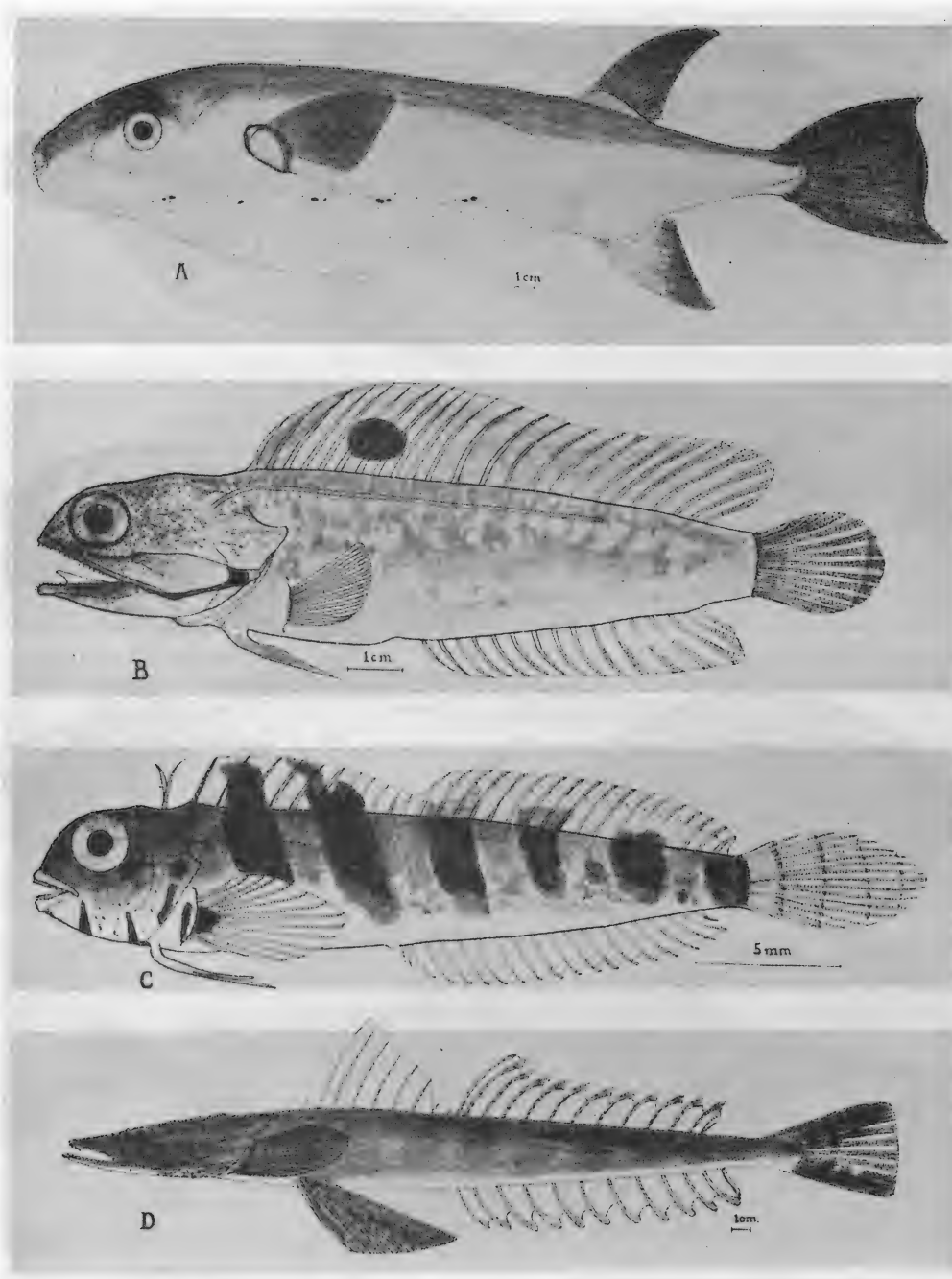


A. *Xenolepidichthys dalgleishi* Gilchr.
B. *Coccotropus jubatus* sp. nov.
C. *Hoplegnathus robinsoni* Rgn.



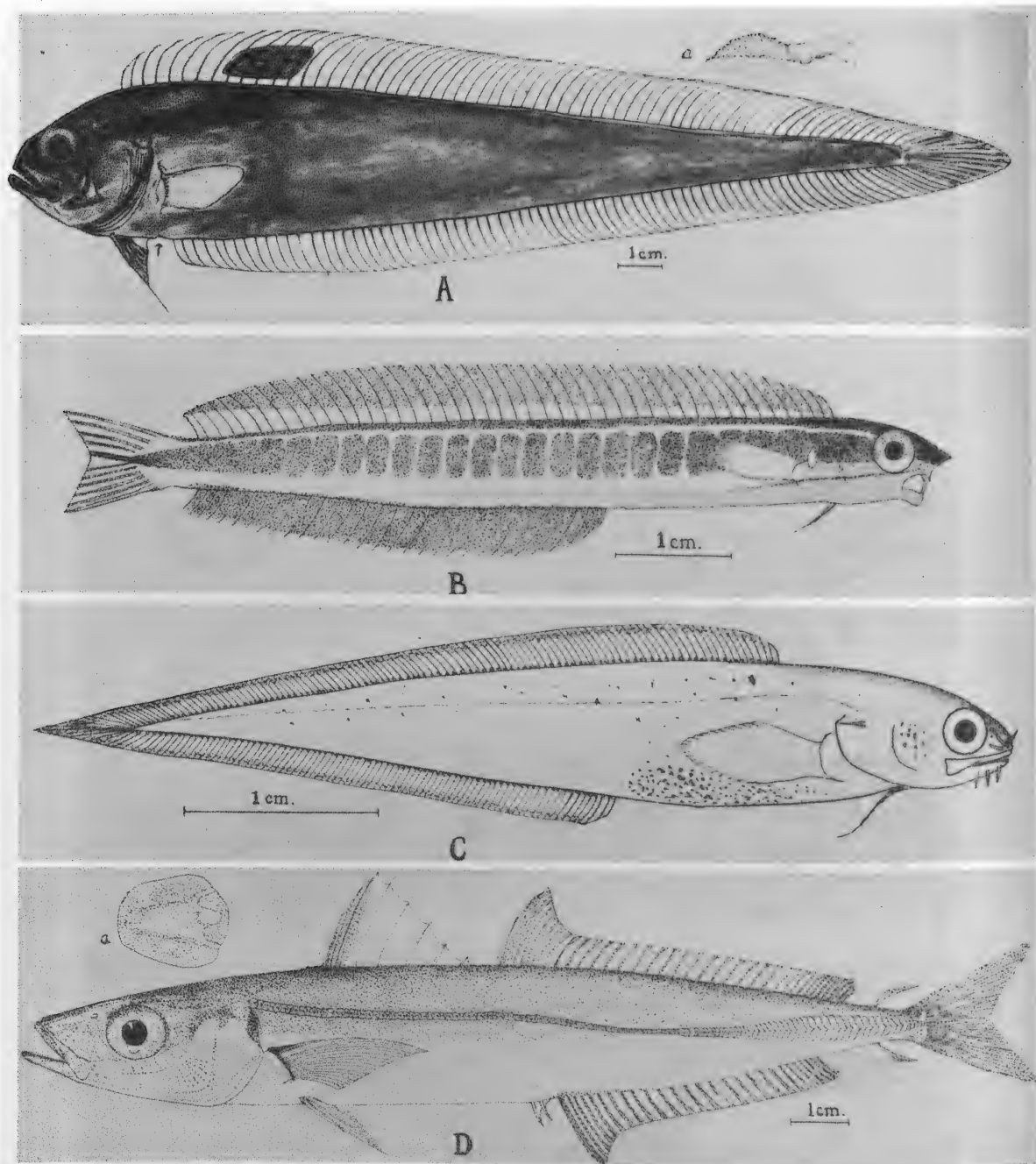
A. *Psenes whitelegii* Waite.
C. *Iso natalensis* Rgn.

B. *Monacanthus setifer* Benn.
a. Median body scale x 15.



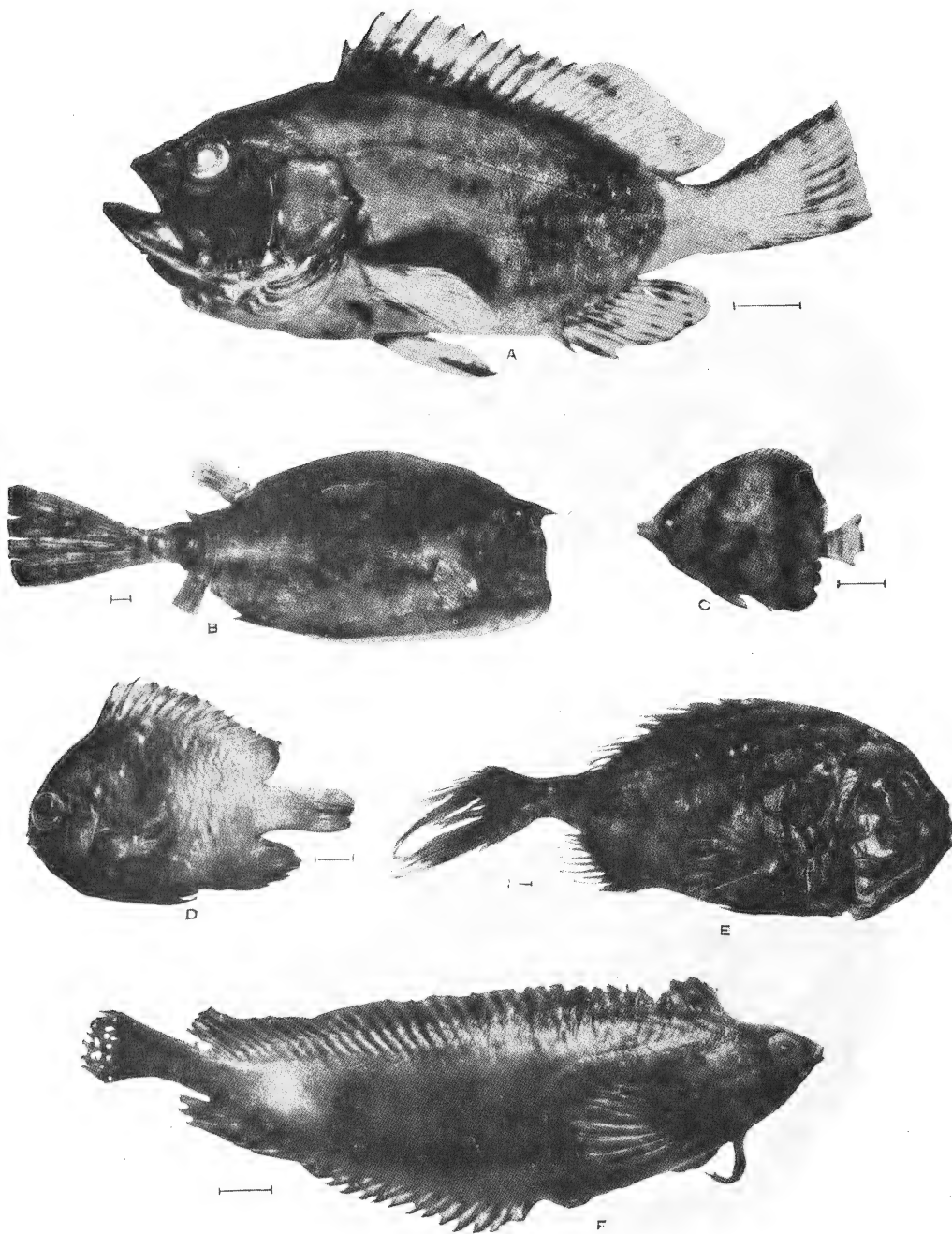
A. *Tetrodon lagocephalus* Linn.
C. *Blennius bifilum* Gunth.

B. *Opisthognathus macrostomus* sp. nov.
D. *Platycephalus indicus* Linn.



A. *Acanthocephala cuneatus* sp. nov.
a. Lateral line scale.
C. *Brotula palmietensis* sp. nov.

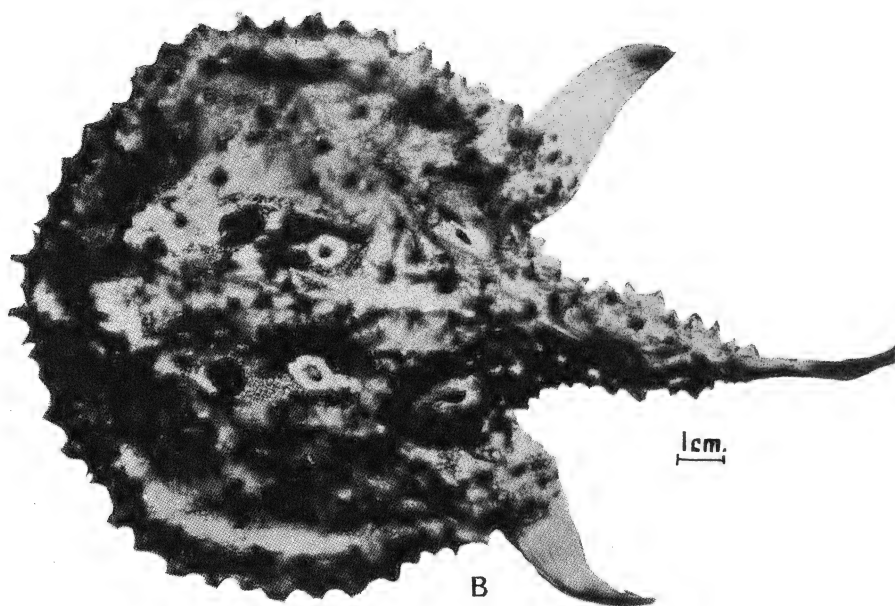
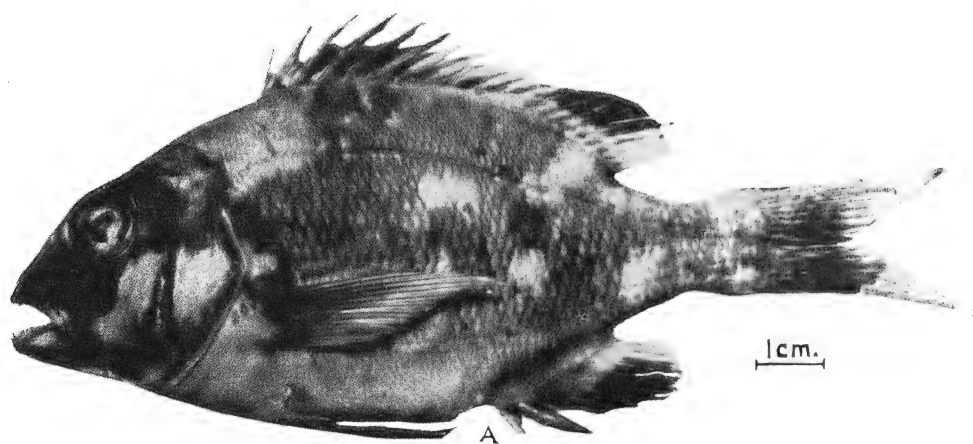
B. *Petrosirtes tapeinosoma* Blkr.
D. *Decapterus lajang* Blkr.
a. Anterior lateral line scale x 8.



A. *Epinephelus flavocaeruleus* Lac.
C. *Chaetodon marleyi* Rgn.
E. *Hoplostethus gilchristi* sp. nov.

B. *Lactophrys quadricornis* Linn.
D. *Dascyllus axillaris* sp. nov.
F. *Clinus heterodon* C. & V.

(The line below each figure represents one centimetre.)



A. *Pagrus nasutus* Cast.

B. *Halieutea fitzsimonsi* G. & T.

From A Guide to the Vertebrate Fauna of the Eastern Cape Province of South Africa. Part II. Reptiles, Amphibians and Fresh-water Fishes. pp. 119–141. Pls. XXIX–XXXIV. 1937. Albany Museum, Grahamstown.

FRESH-WATER FISHES OF EASTERN CAPE
PROVINCE. By DR. J. L. B. SMITH.

Class PISCES.

(Fishes, breathing by gills.)

Sub-class TELEOSTOMI.

(Fishes other than "Sharks" or "Rays.")

Order TELEOSTEI.

(True Bony Fishes.)

About 40 genera and over 200 species of fishes are known to occur in the fresh waters of South Africa. By far the greatest number of those are found in Natal, Transvaal, and Rhodesia, relatively few in the Cape Province, while only 28 species are known from the waters of the South-eastern Cape.

Our knowledge of even the scanty ichthyfauna of the latter region is far from complete, for no systematic investigation has apparently ever been undertaken there. Additional records, and probably even new species, await discovery, although the conditions in the South-eastern Cape preclude the possibility of the existence of varied and abundant fish life. There are no natural extensive permanent bodies of water. The existing waters are generally subject to rapid and extreme variation between drought and inundation, both of which take heavy toll of fish life. Inevitably also, the devices of man still further reduce the already depleted numbers. Drought-restricted pools are swept by nets, while unscrupulous persons not infrequently destroy all life by the use of explosives.

Our rivers are normally merely a series of disconnected pools, which during a drought may largely disappear, or become so foul or saline that only a few species may survive. During floods a large proportion of those fishes which have survived are swept out to sea and destroyed.

It is not at all unlikely that in our natural waters the numbers of individuals, and even of species, are becoming steadily less. This is regrettable, but as our inland fishes are not ever likely to be of economic significance there is

little possibility that any serious effort will be made to readjust matters.

Besides indigenous species, there are present also in our area certain others, which have been introduced from the Northern Hemisphere, chiefly as angling fishes. The Carp, the Trout, and most recently the Black Bass, are the most common. The former two have long been established, and in certain parts of South Africa have been flourished and multiplied; in the case of the Carp often at the expense of the natural fauna.

At least one of our fishes, the "Geel-vis" (*Barbus holubi*) attains a fair size, and ranks high as a game-fish. Large sums have been expended upon those imported species, and it is to be regretted that a part of that money has not been diverted to the propagation of species such as the "Geel-vis." In our area, where the Trout is only moderately successful, the "Geel-vis," with little attention, would probably flourish and provide excellent angling.

Systematic Account.

Below will be found a brief account of the main external features and dimensional relationships which are chiefly employed in diagnosis and identification of fishes.

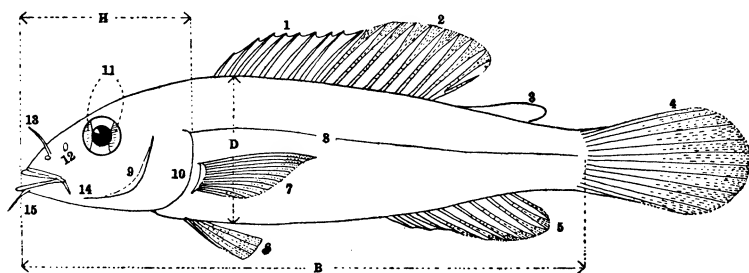
Fins are of three kinds: they may be composed of bony spines, or of soft articulated rays, or they may be rayless or fleshy, known as *adipose*. Fin formulae are written in abbreviated form: D=dorsal fin; A=anal fin. Spines are indicated by Roman, rays by Arabic numerals. D. XII. 10, indicates 12 spines and 10 soft rays in a single undivided dorsal fin. D. VI. + 1, 8. indicates two separate dorsal fins, the first of 6 spines, the second of 1 spine and 8 rays.

Scales are broadly of two kinds: *cycloid* scales have a smooth external margin; *ctenoid* scales have the hind margin coarsely or finely toothed or serrate. Various scale-counts are employed—l.l.=lateral line; l.tr.=lateral-transverse series; e.g. l.l. 37 indicates that there are 37 scales in the lateral line from its origin at the shoulder to the base of the caudal fin. When there is no lateral line the number of lateral series of scales between the same limits is taken. When there are two lateral lines the count is written, e.g. $\frac{15}{17}$, which indicates 15 scales in the anterior (or upper)

lateral line, and 17 in the posterior (or lower) lateral line.
 l.tr. $\frac{4-5}{7-9}$ indicates 4-5 transverse series of scales between the top of the body and the lateral line, and 7-9 series between the lateral line and the belly.

Adipose eyelids are translucent skinny eyelids which generally cover only part of the eye. They are usually not easily seen in live or fresh specimens.

Short barbels are easy to overlook; gentle probing with a needle will disclose whether they are present or not.



TEXT-FIG. 1.—Diagram of bony fish, showing chief dimensions.

B. Length of body. D. Depth of body. H. Length of head.

1. Spinous dorsal fin. 2. Soft dorsal fin. 3. Adipose dorsal fin. 4. Caudal fin (rounded). 5. Anal fin. 6. Ventral (pelvic) fin. 7. Pectoral fin. 8. Lateral line. 9. Preopercle. 10. Opercle. 11. Adipose eyelids. 12. Snout. 13. Nasal barbel. 14. Maxillary barbel. 15. Mandibular barbel.

Gills and gill-rakers.—Gill-rakers are finger-like processes on the upper surface of the cartilaginous gill-arches. On the lower surface of these are the vascular (usually red) gill-filaments. The number of gill-rakers on the lower (longer) limb of the outer gill-arch is counted. This count may generally be made merely by lifting the operculum (or gill-cover), when the outer gill-arch generally is fully exposed.

Dimensional Relationships.

Length of body: measured from the tip of the snout to the base of the caudal fin [Text-fig. 1, B].

Depth of body: the greatest depth of the body, wherever it may occur [Text-fig. 1, D].

Length of head: measured from the tip of the snout to the hind margin of the operculum, or gill-cover [Text-fig. 1, H].

Dimensional relationships are remarkably constant in

any one species, and are important in diagnosis and identification.

The relationships are expressed in an abbreviated form, *e.g.* "depth 3, head 3-4 in body length" indicates (*a*) that the maximum depth of the body is contained 3 times in the length of the body, *i.e.* the depth is $\frac{1}{3}$ of the length; obviously the more slender the body the greater will be the depth cipher; (*b*) that the length of the head varies from $\frac{1}{3}$ - $\frac{1}{4}$ of the body length. Also "eye 5.5 in head" indicates that the head is 5.5 times the length of the diameter of the eye.

**Key to the Families of Fresh-water Fishes of the
Southern-eastern Cape.**

- I. Caudal fin united with dorsal and anal fins.
 - A. Barbels present. Spine in pectoral fin. Plotosidae (p. 130).
 - B. Barbels and fin-spines absent. Anguillidae (p. 131).
- II. Caudal fin free, separate from dorsal and anal.
 - A. A spine in the pectoral fin. Bagridae (p. 129).
 - B. No pectoral spine.
 - X. A single dorsal fin (spine + rays, or rays only).
 - a.* No lateral line.
 - x. Caudal deeply forked. Clupeidae (p. 139).
 - y. Caudal truncate or rounded. Galaxiidae (p. 140).
 - b.* A single lateral line.
 - x. Barbels present. Cyprinidae (p. 122).
 - y. Barbels absent.
 - a.* Soft dorsal and anal elevated anteriorly. Monodactylidae (p. 139).
 - β.* Soft dorsal and anal not elevated anteriorly. Centrarchidae (p. 141).
 - c.* Two lateral lines.
 - x. 3-4 anal spines. Cichlidae (p. 132).
 - y. 5 or more anal spines. Anabatidae (p. 134).
 - Y. Two separate dorsal fins.
 - a.* Posterior dorsal adipose. Salmonidae (p. 140).
 - b.* Posterior dorsal normal.
 - x. 4 spines in first dorsal. Mugilidae (p. 135).
 - y. 6 spines (weak) in first dorsal. Gobiidae (p. 137).

Family CYPRINIDAE. Members of this family are found throughout Africa; most are small, but some species attain a fair size. Easily recognised by the scaly body, and by the presence of one or two barbels. Three genera occur in the South-eastern Cape.

- I. Mouth more or less normal, lips do not form a sucking disc.
 - A. Dorsal fin short, base shorter than head. Barbus.
 - B. Dorsal fin longer, base longer than head. Cyprinus.
- II. Mouth inferior, lips form a sucking disc. Labeo.

Genus **BARBUS** Cuvier.

Smallish mouth, sometimes overhung by snout. Usually one or two barbels on each side. Dorsal and anal fins short, the former sometimes with the last spine enlarged, and serrate behind. Scales fairly large; lateral line present, sometimes incomplete. In some species breeding males develop spiny tubercles on the head.

The species are numerous and usually abundant in the fresh waters of Africa and Asia. Most are small, but some, *e.g.* the "Mahaseer" of India and our own "Geel-vis," attain a large size, and are angling fishes of the first rank.

Some of the smaller species (*e.g.* **paludinosus**) occur in vast numbers, and being carnivorous probably play a considerable part in combating the mosquito menace in tropical and sub-tropical areas. Those species multiply even in restricted waters, so that they might perhaps with advantage be used to stock waters in mosquito-infested areas in South Africa.

Key to the Eastern Cape Species.

- I. A single barbel on each side.
 - A. Last dorsal spine serrated behind. **trevelyani.**
 - B. Last dorsal spine not serrated.
 - x. Barbel less than to equal to eye diameter. **anoplus.**
 - y. Barbel $1\frac{1}{2}$ times eye diameter. **senticeps.**
- II. Two barbels on each side.
 - A. Last dorsal spine serrated behind.
 - x. Ventral base entirely in advance of dorsal. **paludinosus.**
 - y. Ventral base partly in advance of dorsal. **brookingi.**
 - z. Ventral base below middle of dorsal. **capensis.**
 - B. Last dorsal spine not serrated.
 - x. Striae on exposed surface of scales more or less parallel, longitudinal.
 - α . Lips produced into lobes. **gilchristi.**
 - β . Lips normal. **holubi.**
 - y. Striae on exposed surface of scales radiating fan-wise.
 - α . Lateral line complete.
 - i. Base of ventral in advance of dorsal. **vulneratus.**
 - ii. Base of ventral below dorsal. **burchelli.**
 - β . Lateral line obsolete posteriorly. **hemipleurogramma.**

Barbus trevelyani Gunther. [Pl. 29, Fig. 1.]—Depth 3.4–4, head 3.7–4 in body length. A single barbel on each side, slightly less than eye. D. III. 7, third spine strong, serrated behind on upper part only. A. III. 5. Pectoral 1.2 in head, not reaching ventral. Scales radiately striate

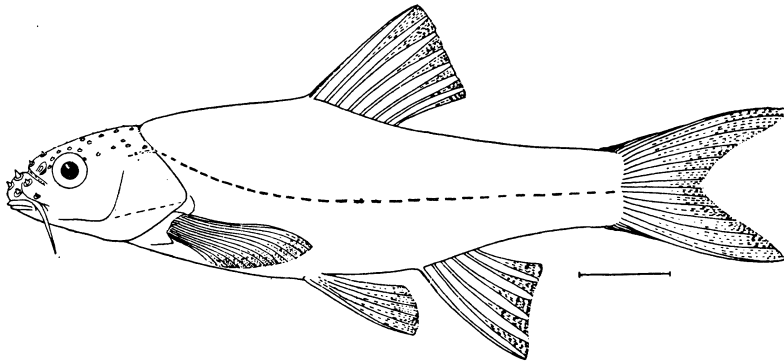
33-36, l.tr. $\frac{5-6}{5-6}$; 3-4 between lateral line and ventral base.

Brown-yellow, darker above. A dark lateral stripe above lateral line, ending near caudal base in a round dark spot. L.R.S.† 4 inches.

Recorded from the Buffalo River near Kingwilliamstown.

Barbus anoplus Weber. "Rooi-vlerk" or "Red-fin."

[Pl. 29, Fig. 2.*]—Depth 3·5-4·5, head 3-4 in body length. Eye 3-5 in head. A single barbel on each side, slightly less than or equal to eye. D. III. 7, third spine feeble, not



TEXT-FIG. 2.—*Barbus senticeps* (J. L. B. Smith).

serrate. A. III. 5, pectoral 1·2 in head, not reaching ventral.

Scales radiately striate, 32-38 l.tr. $\frac{5-7}{5-7}$, 4-5 between lateral line and ventral base. Lateral line occasionally not complete posteriorly. Brown-yellow, darker above, some specimens almost golden. A narrow lateral streak above lateral line, sometimes ending in a spot. Usually a bright red spot at bases of some or all fins except caudal. L.R.S. 5 inches.

Common throughout the fresh waters of the Cape, often found in dams and reservoirs; found also in the Free State, Natal, and Transvaal.

This little fish thrives in even small garden ponds, and is able to survive fairly long journeys in vessels containing water. Breeding males often have spiny tubercles on the head.

Barbus senticeps J. L. B. Smith. [Text-fig. 2.]—Depth equal to head, 3·4 in body length. Eye 5 in head. A single

† L.R.S. = Largest recorded size.

* Figures so marked after Boulenger, "Freshwater Fishes of Africa."

barbel on each side, 1.5 times eye. Large spiny tubercles on the snout and chin. D. III. 7, third spine feeble, not serrate, A. III. 5. Pectorals 1.3 in head, reach ventral base. Scales radiately striate, 30, l.tr. 8, 3 between lateral line and ventral base. Dark olive-brown above, lighter below. An obscure dark lateral stripe. Tubercles reddish. L.R.S. $3\frac{1}{2}$ inches.

Known only from the type, from Kromme River, Assegai Bosch.

Barbus paludinosus Peters. "Gilliminkie." [Pl. 30, Fig. 4.*]—Depth 3.5–4.5, head 3–4 in body length. Eye 3.5–4.5 in head. Two barbels on each side, anterior short, posterior less than or equal to eye. D. III. 7, last spine very strong, strongly serrated behind. A. III. 5. Pectoral 1.1–1.5 in head, reaches ventral base. Ventral entirely in advance of dorsal. Scales radiately striate. l.l. 33–36, l.tr. $\frac{6-7}{5-6}$, 3–4 between lateral line and ventral base. Yellow or silvery, darker above. Sometimes a dusky lateral streak, L.R.S. $3\frac{1}{2}$ inches.

Common in reservoirs and dams round Grahamstown and throughout the Eastern Cape. Extends to Transvaal and Rhodesia. Occurs in vast numbers in even small dams and thrives in garden ponds. Consumes mosquito larvae with avidity.

Barbus brookingi Gilchrist. [Pl. 30, Fig. 3.*]—Depth equal to head, 4 in body length. Eye 4 in head, 2 barbels on each side, posterior longer, 1.3 in eye. D. III. 7, last spine enlarged, somewhat feebly serrated behind. A. III. 5. Pectoral 1.5 in head, not reaching ventral. Ventral base in advance of dorsal. Scales radiately striate, 33, l.tr. $\frac{6}{5}$, 3–4 between lateral line and ventral base. Brown-yellow, a faint dark lateral streak ending in a dark spot. L.R.S. 4 inches.

Known only from the type from East London. A doubtful species, probably identical with the preceding.

Barbus capensis A. Smith. "Witte-vis" or "Silver-fish." [Pl. 30, Fig. 1.*]—Depth 3.7–4.4, head 3.5 in body length. Eye 5–7 in head. Two barbels on each side, about equal, 1.2–1.7 times eye diameter, D. III. 8, last spine strong,

serrated behind. A. III. 6. Pectoral 1.3–1.7 in head, not reaching ventral. Ventral below middle of dorsal. Scales radiately striate, 39–40, l.tr. $\frac{6-7}{6}$, 4 between lateral line and ventral base. Dirty white or silvery, darker above. L.R.S. 14 inches.

Common in the rivers of the Cape Province, extends to Natal.

This is one of the species of *Barbus* which is of some significance as a food and angling fish. It takes baits such as worm, crickets, or grasshoppers freely at times, will even rise to artificial fly, and on light tackle provides good sport. Fairly large numbers are taken by drag-net in the river pools of the Eastern Province. When taken from clear water the flesh is very tasty. The numerous fine bony ribs are troublesome, but in parts where fresh marine fish is not easily obtained this species is highly esteemed.

Barbus gilchristi Blgr. [Pl. 29, Fig. 3.*]—Depth 4.5, head 3.8 in body length. Eye 5 in head. Two barbels on each side, posterior longer, slightly longer than eye. Lips very thick, both produced into median lobes. D. III. 8, third spine feeble, not serrate. A. II. 5. Pectoral 1.7 in head. Ventral below dorsal. Scales longitudinally striate, 42, l.tr. $\frac{6}{7}$, 4 between lateral line and ventral base. Brown above, lighter below, dusky spots above lateral line. L.R.S. 7 inches.

Known only from Barkly East.

Barbus holubi Stndnr. “Geel-vis,” “Yellow-fish.” [Pl. 31, Fig. 1.*]—Depth equal to head, 3–4 in body length. Eye 3–6 in head. Two barbels on each side, posterior usually longer, 1–1.5 times eye. D. IV. 8, fourth spine strong but not serrate. A. III. 5. Pectoral almost as long as head. Ventral below front margin of dorsal. Scales longitudinally striate, 34–43, l.tr. $\frac{6-7}{6-7}$, 3–4 between lateral line and ventral base. Golden yellow, darker above. L.R.S. no precise data, probably over 30 inches.

Occurs in rivers throughout the Union of South Africa, also in South-West Africa.

A game fish, providing excellent sport. Rises to arti-

ficial fly. An excellent bait is a small cricket or grasshopper suspended a few inches below the surface of the water by a small float. This species is fairly voracious, and takes most baits when on the feed.

The habits and breeding habits of this species might repay study. Many waters which do not suit imported game fishes might perhaps with advantage be stocked with this species, which is our best indigenous fresh-water game fish.

Barbus vulneratus Cast. [Pl. 31, Fig. 2.*]—Depth equal to head, 4 in body length. Eye 4–5 in head. Two barbels on each side, posterior longer, equal to eye. D. III. 7, third spine feeble, not serrate. A. III. 5. Pectoral 1·2 in head. Ventral in advance of dorsal. Scales radiately striate, 32–34, l.tr. $\frac{5}{5-6}$, 3–4 between lateral line and ventral base. Brown above, lighter below. A longitudinal series of spots, increasing in size posteriorly. L.R.S. $3\frac{1}{2}$ inches.

Found in the Cape Province. Recorded also from the Transvaal.

Barbus burchelli A. Smith. [Pl. 30, Fig. 2.*]—Depth equal to head, 3–4 in body length. Eye 4–6 in head. Two barbels on each side, posterior longer, up to 1·4 times eye. D. III. 7, last spine feeble, not serrate. A. III. 5. Pectoral 1·3 in head. Base of ventral below dorsal. Scales radiately striate, 33–38, l.tr. $\frac{5-6}{6}$, 4 between lateral line and ventral base. Brown, darker above, lighter below. L.R.S. 5 inches.

Common in the South-west Cape. Now recorded also from the Buffalo River, East London. Will probably be found throughout the Eastern Province.

Barbus hemipleurogramma Blgr. [Pl. 29, Fig. 4.*]—Depth equal to head, 3–4 in body length. Eye 3–4 in head. Two barbels on each side, posterior longer, up to 1·5 times eye. D. III. 7–8, last spine feeble, not serrate. A. II. 5. Pectoral 1·3 in head. Ventral below dorsal. Scales radiately striate, 27–29, l.tr. $\frac{4}{4-5}$, 2–3 between lateral line and ventral.

Lateral line incomplete, tubules on 8–15 scales. Coppery red, darker above, light below. Six or more dark spots along the side. L.R.S. 3 inches.

Baakens River, Port Elizabeth. Also from the Transvaal.

Genus CYPRINUS Linn.

The common Carp of Europe, *Cyprinus carpio* Linn. has long been established in South Africa, where it not only thrives but often does so at the expense of our indigenous fishes. It is well known that it is unprofitable to liberate the young of species such as the Trout in waters containing Carp.

Several curious varieties of the Carp exist, notably the "Mirror Carp," which has only a few very large isolated scales. This form is found in the Great Fish River.

Carp are reputed to live to a great age, and to attain a large size; specimens weighing over 40 lb. are not uncommon. The Carp does not rank high as an angling fish, being rather sluggish. When taken from clear water the flesh is quite palatable. Many farmers stock their dams with Carp, which generally multiply rapidly, even in comparatively muddy or foul water.

Genus LABEO Cuv.

Body slightly compressed, with moderate to small scales. Mouth fairly large, overhung by the snout, the lips forming a sort of sucking disc. No true teeth, but there is a sharp horny cutting edge in each jaw. Barbels present or absent. Generally silvery or yellowish.

Fishes of moderate size, usually found in turbid water. The flesh is soft and tasteless, while fine bones are very numerous.

Only two species have been found in the South-eastern Cape.

Key to the Species.

Two barbels on each side.

I. 44-50 series of scales.

II. 56-60 series of scales.

capensis.

umbratus.

Labeo capensis A. Smith. [Pl. 31, Fig. 3.*]—Depth 3-4, head 4-5 in body length. Eye 6-8 in head. Two barbels on each side, longest equal to eye. D. III-IV. 10-11. A. III. 5. Pectoral nearly as long as head. Ventral below dorsal base. 44-50 scales, l.tr. $\frac{8-9}{11-12}$. Olive-brown above, white or pinkish below. L.R.S. 17 inches.

Rivers and reservoirs, extending to Natal and Transvaal. When the Great Fish River comes down in flood many thousands of this species are thrown up dead on the shore near the mouth of the river.

Labeo umbratus A. Smith. [Pl. 31, Fig. 4.*]—Depth 3·5–4·5, head 4–4·5 in body length. Eye 5–6 in head. Two barbels on each side, neither as long as eye. D. III. 9. A. III. 5. Pectoral nearly as long as head. Ventral below dorsal. 56–60 scales l.tr. $\frac{12-14}{14-16}$. Brown above, yellowish below. Small dark spots on upper part of side. L.R.S. 10 inches.

Rivers of the Cape Province, also in Natal and Transvaal.

Family BAGRIDAE. “Cat-fishes,” “Barbels.” A large family of numerous genera and species, found in the tropical and temperate waters of the world, generally of sluggish habit. They are easily recognised by the slimy scaleless body, together with the well-developed barbels, sometimes branched, and by the presence of a serrated spine in the pectoral fin.

These fishes appear to be able to survive even prolonged droughts, and, it has been stated, may remain dormant in the dried mud from a pool, to revive when the water returns. Many of the species live for a considerable time out of water. Species of *Clarias*, if wrapped in moist cloth or straw, will survive long journeys.

Only two genera have been recorded from the Eastern Province.

Key to the Genera.

- I. A single dorsal fin, spineless. *Clarias*.
- II. Two dorsal fins, the first with a spine, the second adipose. *Gephyroglanis*.

Genus *CLARIAS* Gron.

Body elongate, with a single long spineless dorsal. Head depressed, bony. Eye small. Four pairs of barbels. Minute teeth in jaws.

Five species in South Africa, only one recorded from the Eastern Province.

Clarias gariepinus Burch. “Barbel” or “Barber.”—Depth 5–7, head 3–3·8 in body length. Eye very small. Head granular above, with two median pits. One nasal, one

maxillary, and two mandibular barbels, the latter three nearly as long as head. D. 65–80, originates above tip of pectoral. A. 50–60. Both fins reach nearly to caudal, which is free and rounded. Pectoral with serrated spine. Reddish or brown or slaty above, sometimes mottled lighter below. Attains a weight of over 100 lb.

Extends from the Cape as far as Mozambique.

This is our largest fresh-water fish, but is so sluggish as to be of little interest to anglers. Usually taken on set lines, using worm or meat as bait. Very plentiful in the Orange River and tributaries. When those rivers are low natives secure numbers of fishes by spearing in the muddy bottoms of pools. Individuals over 100 lb. in weight are not uncommon. The flesh is palatable, but is something of an acquired taste, being reddish and rather tough. These fishes are very tenacious of life; after being exposed to the air during a whole day even in summer they will revive within a few moments when placed in water. After removal from the fish the heart will continue to beat for some time, especially if placed in water.

Genus **GEPHYROGLANIS** Blgr.

Body moderately compressed. Two dorsal fins, both short, the first normal, with a spine, the posterior adipose. Four pairs of barbels. Minute teeth in jaws.

Only one species in South Africa.

Gephyroglanis sclateri Blgr. [Pl. 33, Fig. 1.*]—Depth 4.5–6, head 4 in body length. Eye 6–7 in head. Nasal barbel minute, maxillary and 2 mandibular barbels longer, but longest only half head length. First dorsal of one smooth spine and 7 rays. Adipose dorsal long and low. A. 16–17. Pectoral with serrated spine. Caudal free, forked. Dark brown above, lighter below. L.R.S. 15 inches.

Eastern Cape to Natal and Transvaal.

Family PLOTOSIDAE. A family of curious fishes, mostly marine and estuarine, of the Indo-Pacific region. Some species live in fresh water.

Only one genus and species in South Africa.

Plotosus anguillaris Bloch. “Barbel eel.” [Pl. 34, Fig. 2.*]—Body more or less compressed, tapering posteriorly, scaleless. Depth 6–8, head 4.5–5 in body length. Eye

6-7 in head. Mouth large, with conical teeth in upper jaw. On each side one nasal, one maxillary, and two mandibular barbels, moderately long. Two dorsal fins, the first short, with a serrated spine; the second long, confluent round caudal with anal. Pectoral with a serrated spine. Brownish to darker above, slightly lighter below. Sometimes 2 or 3 bluish or lighter longitudinal streaks. L.R.S. 16 inches.

Occurs in the sea and also high up in tidal rivers, even to fresh water, from the Cape to Natal.

These fishes should be handled with care, for the serrated spines inflict most painful wounds which may even prove dangerous. There are no actual poison-glands, but the mucus enveloping the spines appears to be highly toxic.

Family ANGUILLIDAE. "Eels." Eels are well known and easily recognised. It has been shown by the late Dr. J. Schmidt of Copenhagen that only one species of eel, *Anguilla mossambica* Peters, occurs in the fresh waters of South Africa.

Anguilla mossambica Peters.—Body very elongate, with minute scales embedded in the skin. Pectorals present. Dorsal and anal confluent round tail. Mouth large, snout pointed, teeth small. Brown or olive above, lighter below. L.R.S. probably 60 inches.

Almost all fresh waters of the Cape. Extends right through to the Pacific region.

It has been found that the adult eels of the Northern Hemisphere leave the rivers and seek out the depths of the sea near the West Indies, where the eggs are laid. The young hatch out at a depth of 100-150 fathoms, where they remain until they are about 1 inch long. At this stage the young eel, formerly known as *Leptocephalus*, is unlike the adult. The body is deeper, very highly compressed, and quite transparent, being not much thicker than paper. This stage last for about three years, during which time vast hordes of the young of the European species travel across the Atlantic, a large proportion naturally falling a prey to fishes and other creatures. The body now changes to the typical cylindrical form of the adult, and the "elvers," or young eels, ascend the rivers. It is believed that the spent adult eels die after spawning.

The life-history of the African eel has not yet been worked

out. It has been suggested that it probably has a cycle similar to that of the European eel, and the deeps near Madagascar have been suggested as a possible spawning ground. On the other hand, evidence is being accumulated which indicates that our eels may have a totally different life-history, and it is not even improbable that they do not return to the sea at all.

Leptocephalus stadia of many marine eels are fairly common in the sea, but no marine *Leptocephalus* referable to *mossambica* have yet been found; actually no larval stage of that species is known. The Madagascan-deep theory would mean that the *Leptocephalus* would be able to survive the sudden change from the warm waters of the east to the cold waters of the Atlantic, since it has been stated that *mossambica* has been found in the Orange River (though not yet in other rivers of the west coast).

In the quiet coastal fresh waters of the south-eastern coasts of South Africa *mossambica* attains a large size, specimens weighing more than 50 lb. being not uncommon, which prove most formidable antagonists to the angler.

This species has been observed to travel overland from one pool to another.

Family CICHLIDAE. A family of numerous genera and very numerous species, especially abundant in tropical Africa. Most are moderate or small, but some attain a fair size. In the region of the Great Lakes of Central Africa certain species are of economic importance as food-fishes.

The spawning habits of some species (*e.g.* genus *Tilapia*) are of interest. The eggs are laid in a rough nest, usually a hollow in mud or gravel, and after fertilisation are carried in the mouth of the female. Even after they have hatched the young are cared for by the mother, in whose mouth they seek refuge on the approach of danger. This is unusual, for in most other cases where parental care of the young is shown by fishes it is the male who undertakes this duty.

Genus *TILAPIA* A. Smith.

Body compressed, with fairly large scales. Mouth fairly large, with rows of bi- or tricuspid teeth, apically brown. Two lateral lines.

Of the 30 species present in South Africa only two have been recorded from the Eastern Province.

In the Transvaal *Tilapia* species are known as "Kurper."

Key to the Species.

- | | |
|---|---------------------|
| I. 16-20 gill-rakers: D.XV-XVII. 10-12. | <i>natalensis</i> . |
| II. 9-12 gill-rakers: D.XIII-XV. 9-11. | <i>sparrmani</i> . |

***Tilapia natalensis* Weber.** "Mud-fish." [Pl. 32, Fig. 1.*]
—Depth 2.2-2.8, head 2.7-3 in body length. Eye 3-5 in head. Mouth extends almost to below eye. Teeth with a basal cusp, 3-6 rows in upper jaw. 16-20 gill-rakers. D. XV-XVII. 10-12, posterior rays forming a pointed lobe. A. III. 9-10, soft fin similar to dorsal. Caudal truncate. Scales cycloid, 27-32 series, l.tr. $\frac{3-4}{13-16}$, l.l. $\frac{17-21}{11-17}$. Brownish above, lighter to dusky below. Dark blotch on opercle. Dark spots in two series along sides. Young with dusky cross-bars. Soft dorsal and anal with rows of dusky spots. L.R.S. 15 inches.

Cape Province through Natal and Transvaal, as far as Rhodesia.

This species is abundant in the brackish and fresh waters of the coastal region of the Eastern Province. The young may often be seen in shallow water among reeds or rushes. The flesh is palatable.

***Tilapia sparrmani* A. Smith.** [Pl. 32, Fig. 2.*]—Depth 2-2.5, head 3 in body length. Eye 3.5 in head. Mouth large, extending almost below eye. Teeth with single basal cusp, 3-6 rows in upper jaw. 9-12 gill-rakers. D. XIII-XV., posterior rays forming a pointed lobe. A. III. 8-10, posterior rays similar to dorsal. Caudal subtruncate. Scales cycloid, 27-29 series, l.tr. $\frac{2-3}{9-11}$, l.l. $\frac{16-19}{9-12}$. Olive-brown above, scales with lighter margins, dusky below. Young with 7-9 dark cross-bars, which fade with growth. A blotch on the opercle. Soft dorsal, anal, and caudal with rows of dark spots. L.R.S. 6 inches.

Comparatively scarce in the Eastern Province, but one of the most widely distributed species, being found from the Eastern Cape in most waters up to Rhodesia.

Genus **HAPLOCHROMIS** Pfeff.

A genus of doubtful validity, very close to **Tilapia**. Some of the species have conical teeth, but the dentition varies with age. Only one species in our area.

Haplochromis moffati Castlenau. [Pl. 32, Fig. 3.*]—Depth equal to head length, 2.5–2.7 in body length. Eye 3.5–4.5 in head. Teeth in 3–4 series, outer larger and conical, inner bi- or tricuspid. 7–10 gill-rakers. D. XIII–XV. 9–11.

A. III. 8–10. Scales ctenoid, 26–31 series, l.tr. $\frac{3}{10-12}$,

l.l. $\frac{10-12}{6-13}$. Olive or brown, with or without lighter dots, or with faint cross-bars; sometimes a lateral stripe. Soft dorsal, anal and caudal with series of light and dark spots. L.R.S. 5 inches.

Extends from the Eastern Cape to the Congo.

Family ANABATIDAE. Small fishes, found in Africa and Asia, characterised by the possession of an accessory breathing organ, a rudimentary “lung” in a cavity above the gills, which enables them to live for a considerable time out of water.

Genus **ANABAS** Cuvier.

Body scaly. A single long dorsal. Two lateral lines. One species **Anabas testudineus** (usually *scandens*), from India, is commonly known as the “Climbing Perch,” from its supposed habit of climbing trees in search of food.

These fishes do not attain any size, but they are carnivorous and extremely voracious. They thrive even in small permanent pools.

Only two species are recorded from the Eastern Province.

Key to the Species.

- | | |
|---|-----------------|
| I. D. XII–XIV. 7–10; scales 26–29, $\frac{3-4}{9-10}$. | capensis |
| II. D. XV–XVII. 10; scales 31–35, $\frac{6-7}{13-15}$. | bainsii. |

Anabas capensis C. & V. “Kurper,” “Rocky.” [Pl. 33, Fig. 3.*]—Depth 3, head 2.5–3 in body length. Mouth large, with small conical teeth. D. XII–XIV. 7–10. A. VI–

VIII. 8-10. Head scaly except snout. Scales ctenoid, 26-29 series, l.tr. $\frac{3-4}{9-10}$, l.l. $\frac{15-18}{9-14}$. Caudal rounded. Olive-brown above, yellowish on sides and below. Radiating streaks from eye. Dark spot on opercle. L.R.S. 10 inches.

A species *vicinus* Blgr. has been recorded from the Baakens River, Algoa Bay, but it is identical with *capensis*. *Capensis* extends from the Cape Peninsula throughout the Cape midlands; it occurs in waters round Grahamstown, but does not appear to extend east to the Great Fish River.

A most pugnacious and voracious small fish; a specimen was observed attempting to swallow a *Barbus anoplus* quite half its size. This species doubtless consumes a large proportion of the liberated fry of the Trout.

Large numbers may be caught on almost any bait, and provide good sport for the juvenile angler. The flesh of the larger specimens is quite palatable.

Anabas bainsii Cast. [Pl. 33, Fig. 2.*]—Depth equal to head, 2.8 in body length. Mouth large, with small conical teeth. D. XV-XVII. 10. A. VI-VIII. 9-10. Caudal rounded. Head except snout scaly. Scales ctenoid, 31-35 series, l.tr. $\frac{6-7}{13-15}$, l.l. $\frac{15}{15}$. Dark brown above, dusky yellow below. One or more radiating streaks from eye. Dark spot on opercle. L.R.S. 6 inches.

Kingwilliamstown and East London area. Apparently rather a localised species, will probably be found elsewhere.

Family MUGILIDAE. “Mulletts,” “Harders,” “Springers.” Body compressed, scaly. Two dorsal fins. Shoal fishes, mostly of small to moderate size, though some species attain a length of over 36 inches. Some species are cosmopolitan, others circumtropical, and a few localised. Many are of considerable economic significance since they occur in vast numbers. They are largely herbivorous, some omnivorous. Most species are marine or estuarine, but a few live exclusively or partly in brackish or fresh water.

Only one genus in South Africa.

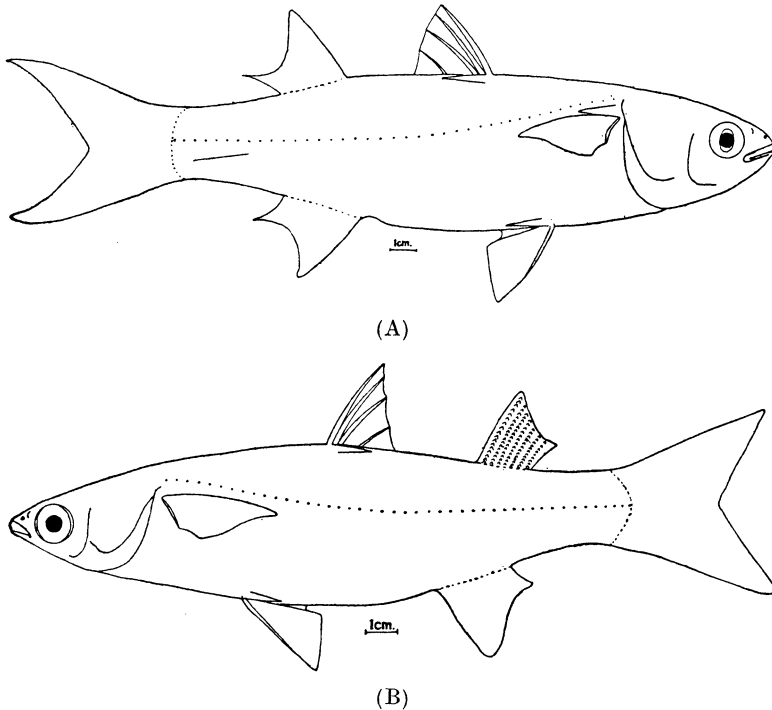
Genus MUGIL Linn.

The first dorsal of four spines. Some species with well-developed adipose eyelids. Scales moderate or large. Mouth

very small, teeth minute or absent. No lateral line, but most scales with pits or canals. Fourteen species are found in South Africa, but only two extend regularly into fresh water.

Key to the Species.

- | | |
|---|-------------------|
| I. Large adipose eyelids, cover most of iris. | <i>cephalus.</i> |
| II. Adipose eyelids rudimentary. | <i>euronotus.</i> |



TEXT-FIG. 3.—A. *Mugil cephalus*, Linn. B. *Mugil euronotus*, A. Smith.
The dots indicate lateral rows of scales.

***Mugil cephalus* Linn.** “Harder,” “Mullet,” “Springer.” [Text-fig. 3, A.]—Depth 4–5, head 4 in body length. Nostrils wide apart. Snout flat and wide. Adipose eyelids well developed, encircle pupil D. IV. + 1, 7. A. III. 8. Pectorals short, with long pointed scale in axil. 39–42 series of scales, l.tr. 14–16. Olive or brown above, silvery on sides and below. Sometimes streaks along sides. Axil of pectoral dark. L.R.S. 30 inches.

Circumtropical. Extends well up tidal rivers and often

found in landlocked vleis and lagoons. In quiet waters specimens over 10 lb. in weight are not uncommon. This species does not usually appear to congregate in shoals.

Mugil euronotus A. Smith. "Springer." [Text-fig. 3, B.] —Depth 4, head 3-4 in body length. Nostrils close together. Adipose eyelids rudimentary. D. IV.+1, 8. A. III. 9. Pectorals short, no scaly process in axil. 43-45 series of scales, l.tr. 14-15. Dark above, shading through dusky to silvery below. L.R.S. 12 inches.

Occurs in most of the fresh waters of the coastal region of the Eastern Province, plentiful not far from Grahamstown. Angling for these fishes is a popular sport, special tackle being employed; the favourite lure is the "flying-ant," or the larger termite. The flesh of fishes from muddy water has a rank flavour.

Family GOBIIDIAE. "Gobies." Small carnivorous fishes, usually found in temperate and tropical seas, some entering fresh water.

A single genus **Gobius** is found in our fresh waters.

Genus **GOBIUS** Art.

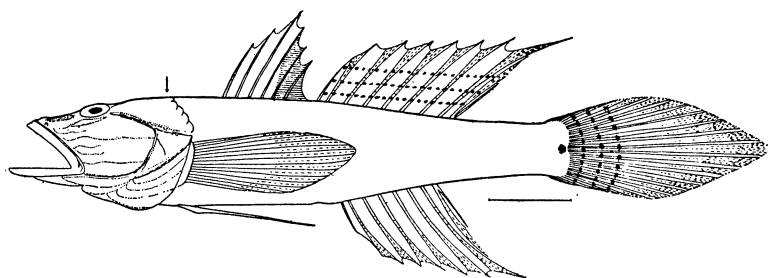
Ventrals (pelvics) united, forming a feeble sucking disc (by which the fish may adhere to stones or any smooth surface). Scales ctenoid, often obscured by a thick coating of mucus. Mouth large, teeth small, conical, sometimes posterior enlarged canines. Gill-openings restricted. Two dorsal fins, the first of six spines. Three species in the fresh waters of the Eastern Province.

Key to the Species.

- | | |
|--|---------------------|
| I. Lower jaw projecting beyond upper. | |
| A. Caudal pointed, longer than head. | callidus. |
| B. Caudal rounded, not longer than head. | giuris. |
| II. Upper jaw projecting over lower. | aeneofuscus. |

Gobius callidus J. L. B. Smith. [Text-fig. 4.]—Depth 5, head 3 in body length. Eye 5 in head. Papillae in undulating rows on cheeks. Lower jaw projects slightly. D. VI.+1, 8, last soft rays as long as head. A. I. 7, soft rays resemble soft dorsal. Pectoral as long as head. Caudal 1.2 times head. Twenty-eight series of scales, l.tr. 8. Head

naked. Dark olive above, dusky below. A blotch on spinous dorsal, and spots on soft dorsal and caudal. L.R.S. 4 inches. Known only from the type, taken in the Bushman's River, Alicedale.



TEXT-FIG. 4.—*Gobius callidus* J. L. B. Smith.

Gobius giuris Ham. Buch.—Depth 4-5, head 3 in body length. Eye 4-7 in head. Papillae in rows on cheeks. Lower jaw projects strongly. Mouth extends below eye. D. VI. +1, 9, soft rays in second dorsal not nearly as long as head. A. I. 8, soft rays similar to dorsal. Pectoral shorter than head. Caudal shorter than or equal to head. 30-36 series of scales, l.tr. 9-11. Scales on top of head. Brown-olive, with or without blotches on sides. Pectoral, dorsal, and caudal spotted or barred. L.R.S. 15 inches.

Equally at home in the sea or in fresh water. One of the most widely distributed species. Occurs from about Knysna eastwards along the coast to Madagascar, India, and China. In all estuaries and lagoons and in many inland waters in South Africa. This is the largest of the Gobies. It breeds freely in captivity, and in India is kept in tanks and ponds, and is eaten with relish by the natives.

Gobius aeneofuscus Peters.—Depth 5-6, head 3.5 in body length. Eye 4-7 in head. Mouth extends to below eye, upper jaw extends beyond lower. D. VI. +1, 10; A. I. 10. Caudal shorter than head. 58-64 series of scales; l.tr. 16-18. Head naked. Olive-brown above, bronzy on sides, light below. Obscure mottlings on body. Two oblique lines from eye to mouth. Soft dorsal and caudal spotted or barred. L.R.S. 10 inches.

Fresh waters of the Eastern Cape, extending through Natal, Transvaal to Rhodesia. Also in fresh waters of Madagascar.

Family CLUPEIDAE. Herrings and relatives.

Genus GILCHRISTELLA Fowler.

Compressed, almost transparent body. Scales soft, easily shed. Pectorals low down. Ventrals before dorsal. A single short dorsal, anal short or long. Teeth minute or absent. Adipose eyelids absent. A silvery lateral stripe.

Gilchristella aestuarius Glch.—Depth equal to head, 4 in body length. Eye 3 in head. No adipose eyelids. Lower jaw projects, mouth extends to eye. D. 14–16, inserted nearer caudal base than snout tip. A. 18–21, originates below end of dorsal. 40 series of scales; l.tr. 10. Caudal forked. Silvery, back darker, brilliant silvery lateral stripe. L.R.S. 3 inches.

This small Clupeid occurs in the sea, but is found mostly in estuaries. It occurs also in landlocked brackish and freshwater lagoons. These fishes swim in large shoals, and are preyed upon by numerous aquatic birds. The fishes in the shoals have a curious habit of swimming with the head up and the snout just out of the water. On the approach of danger there is a silvery flash and the whole shoal dives a few feet, to reappear a few moments later at the surface. Sometimes known as "Whitebait."

Family MONODACTYLIDAE. Small, deep-bodied, compressed fishes of tropical and temperate waters, some of which are equally at home in the sea and in fresh water. A single dorsal.

Bright silvery, with dark cross-lines on young.

Genus MONODACTYLUS.

Body deep, scaly. Mouth small, protractile. Colour silvery. One species extends from the Cape eastwards, found in the sea and in fresh waters of the Eastern Cape and beyond.

Monodactylus falciformis Lacep. "Moony," "Cape Lady." [Pl. 34, Fig. 1.*]—Body ovate, deeper in the adult, depth 1.5–2, head 3 in body length. Eye 2 in head. D. VIII. 27–30. A. III. 27–30. Front rays of soft dorsal and anal elevated. Ventrals very small. l.l. scales 50–60. Bright silvery. Lobes of soft dorsal and anal dusky. Young with numerous narrow dark cross-bars. L.R.S. 10 inches.

Fresh waters of the Eastern Cape, even near Grahams-town. Often caught by "Springer" anglers. The flesh is rather insipid and deteriorates rapidly.

Family GALAXIIDAE. Small fishes of the Southern Hemisphere, fairly closely related to the Salmonidae (of the Northern Hemisphere).

Some species live and reproduce in fresh water, others are catadromous, *i.e.* return to the sea to spawn, the reverse of some of the Salmonidae, which ascend rivers to spawn (anadromous).

Genus GALAXIAS Cuvier.

Body elongate. A single short dorsal fin. Mouth moderate, with small teeth.

Only one species from the South-eastern Cape.

Galaxias zebratus Cast. [Pl. 34, Fig. 3.*]—Depth 5-6.5, head 3.5-4 in body length. Eye 4 in head. Mouth extends to below eye. Teeth of more or less even length. Lower jaw projects slightly. D. III-IV. 7-8, base shorter than head length. A. III-IV. 7-8. Spines in both fins feeble. Caudal slightly rounded. No lateral line. Grey-brown, mottled to form irregular cross-bars. L.R.S. $2\frac{1}{2}$ inches.

Inhabitants of clear fresh waters, plentiful in the Cape midlands, scarce farther east.

Family SALMONIDAE. "Salmon," "Trout." One species of these carnivorous fishes from the Northern Hemisphere has long been established in certain parts of South Africa. The fishes thrive in the clear waters of the Western Cape, and in the mountain streams of the Eastern Cape and Natal.

The somewhat impermanent turbid waters of the South-eastern Cape do not suit them as well, and even in large permanent reservoirs they have not been as successful as was anticipated.

Two sub-species *Salmo fario fario* Linn, the Brown Trout, and *Salmo fario irideus* Gibbons, the Rainbow Trout, have been firmly established.

Genus SALMO Linn.

Body elongate. Two dorsal fins, the posterior adipose. Mouth large, teeth conical. Body with a heavy coating of mucus.

Two sub-species in South Africa.

- A. Caudal truncated. Dark spots on body. *fario fario*.
 B. Caudal slightly emarginate. A longitudinal purplish stripe. *fario irideus*.

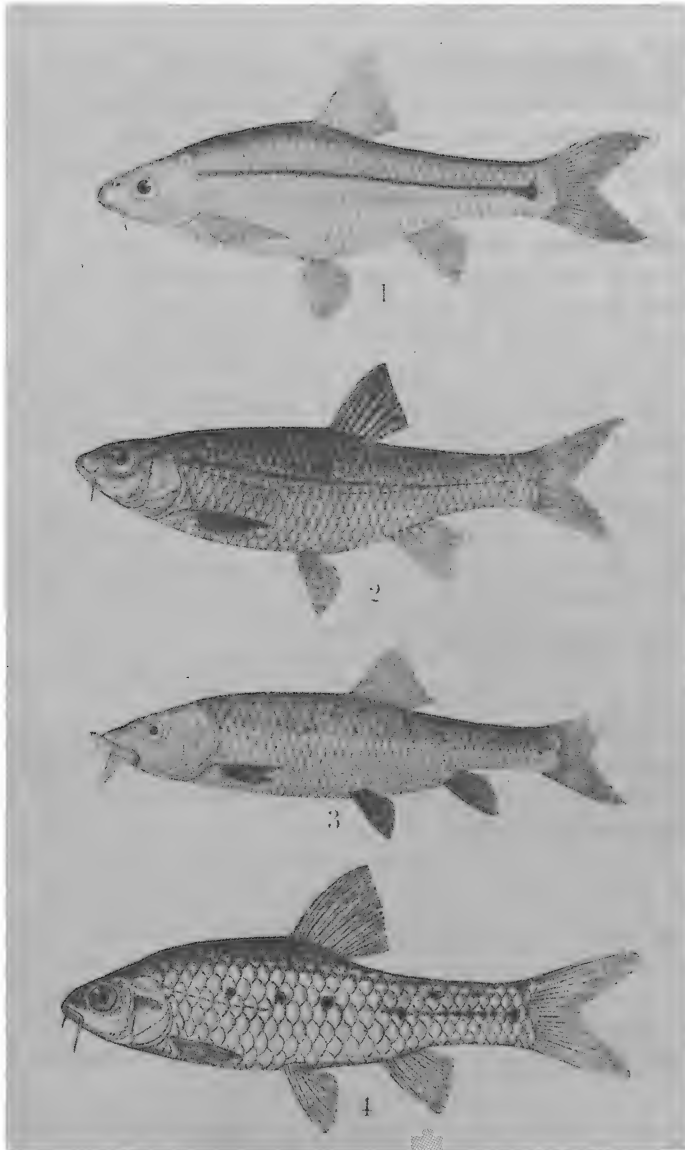
Family CENTRARCHIDAE. The large-mouth Black Bass, *Micropterus salmoides* Lacep., is a recent importation. It has been introduced into waters in numerous parts of South Africa and, where records are available, appears everywhere to flourish.

Micropterus salmoides Linn. "Black Bass." Depth about 3 in body length. Mouth large, extending below eye. Spinous dorsal short, almost separate from soft fin, 3rd and 4th spines longest, hinder spines shorter. Soft dorsal and anal rounded, not elevated anteriorly, of 11-12 rays. Caudal rounded truncate. Superficially resembles the "Kurper," but has a deeper body, only one lateral line, and a shorter spinous dorsal.

Reported to attain a weight of 20 lb. (America); average weight 3-4 lb. Already firmly established in several parts in the South-eastern Cape. This species spawns fairly young, probably from the age of 2 or 3 years, and the eggs and fry are guarded by the male parent.

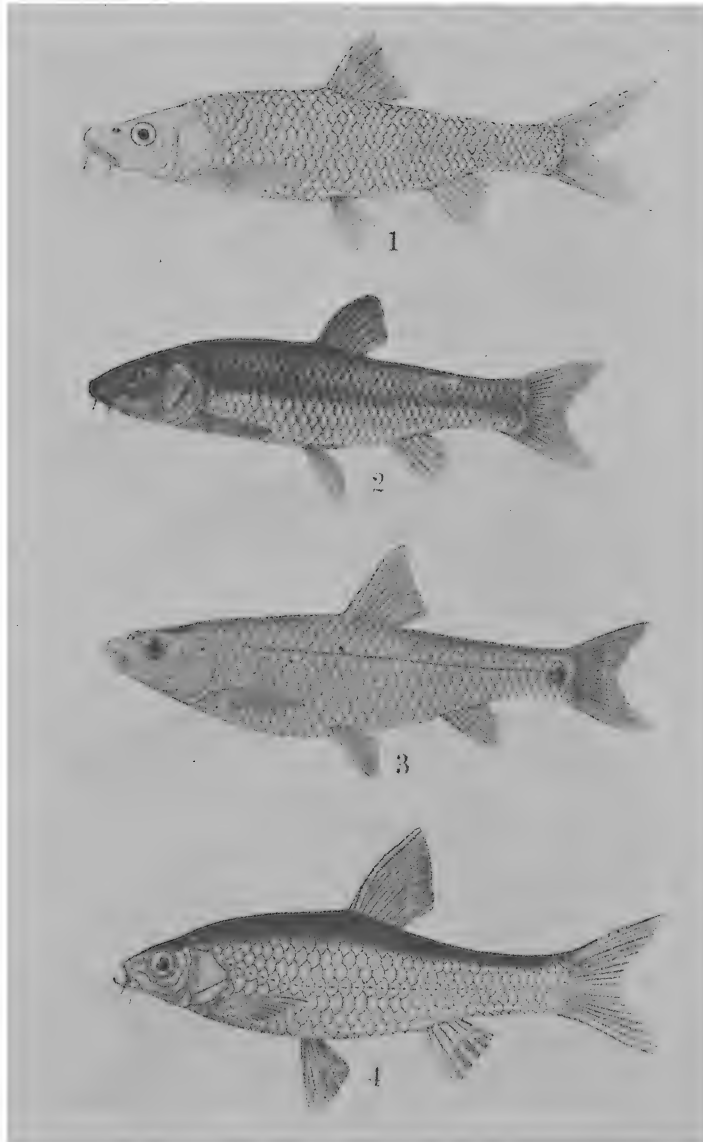
The Black Bass is an active predaceous fish, which appears to take almost any bait or artificial lure. It has been found that while the Trout may almost be prevented from multiplying by the voracious Kurper (*Anabas capensis*), that latter species may actually be exterminated by the more voracious Black Bass.

PLATE XXIX.



(From "Catalogue Fresh-Water Fishes of Africa," British Museum.)

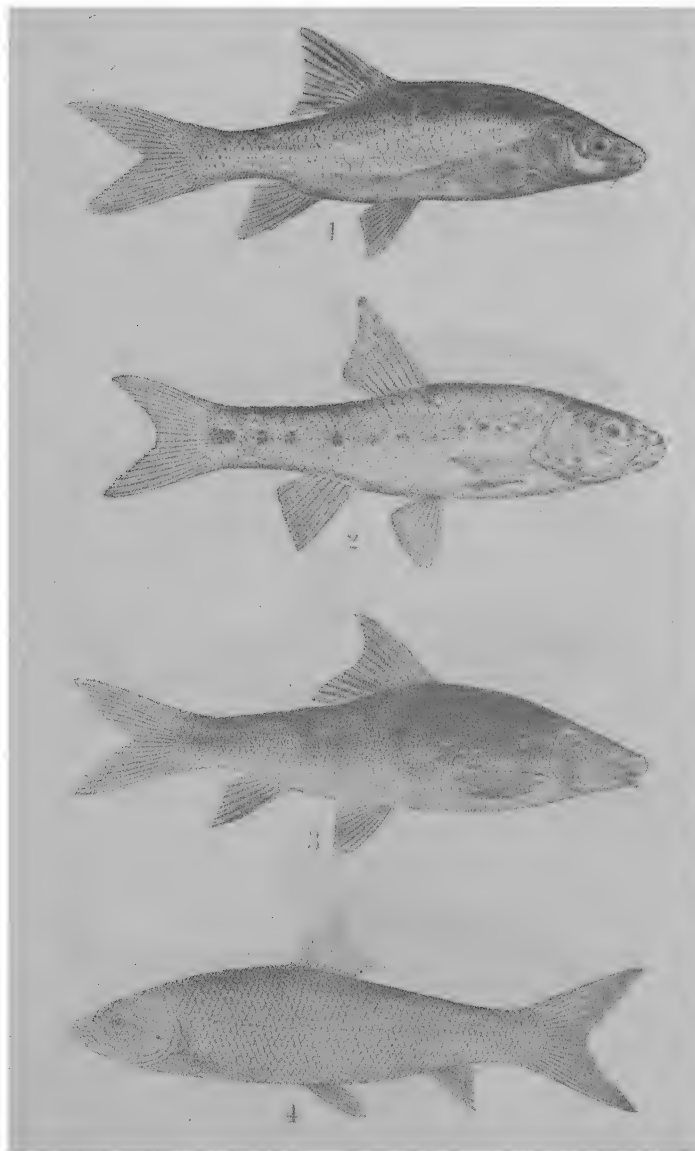
- (1) **Barbus trevelyani** Gnthr. (p. 123); (2) **Barbus anoplus** Weber (p. 124) "Red-fin"; (3) **Barbus gilchristi** Blgr. (p. 126); (4) **Barbus hemipleurogramma** Blgr. (p. 127).



(From "Catalogue Fresh-Water Fishes of Africa," British Museum.)

- (1) *Barbus capensis* Smith (p. 125) "Silver-fish"; (2) *Barbus burchelli* Smith (p. 127); (3) *Barbus brookingi* Gleh. (p. 125); (4) *Barbus paludinosus* Peters (p. 125) "Gilliminkie."

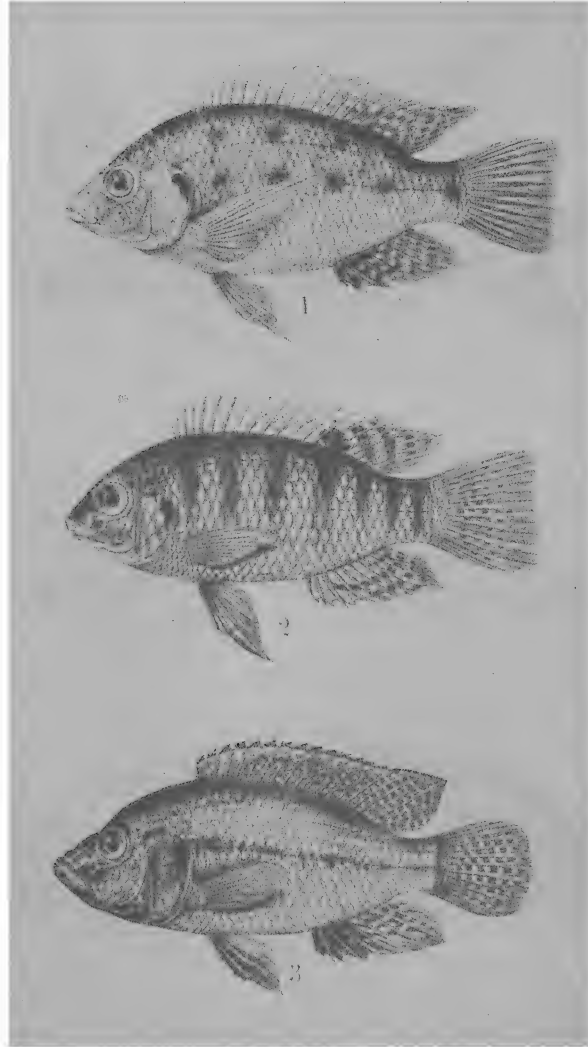
PLATE XXXI.



(From "Catalogue Fresh-Water Fishes of Africa," British Museum.)

- (1) **Barbus holubi** Stndnr. (p. 126) "Yellow-fish"; (2) **Barbus vulneratus** Cast. (p. 127); (3) **Labeo capensis** Smith (p. 128); (4) **Labeo umbratus** Smith (p. 129).

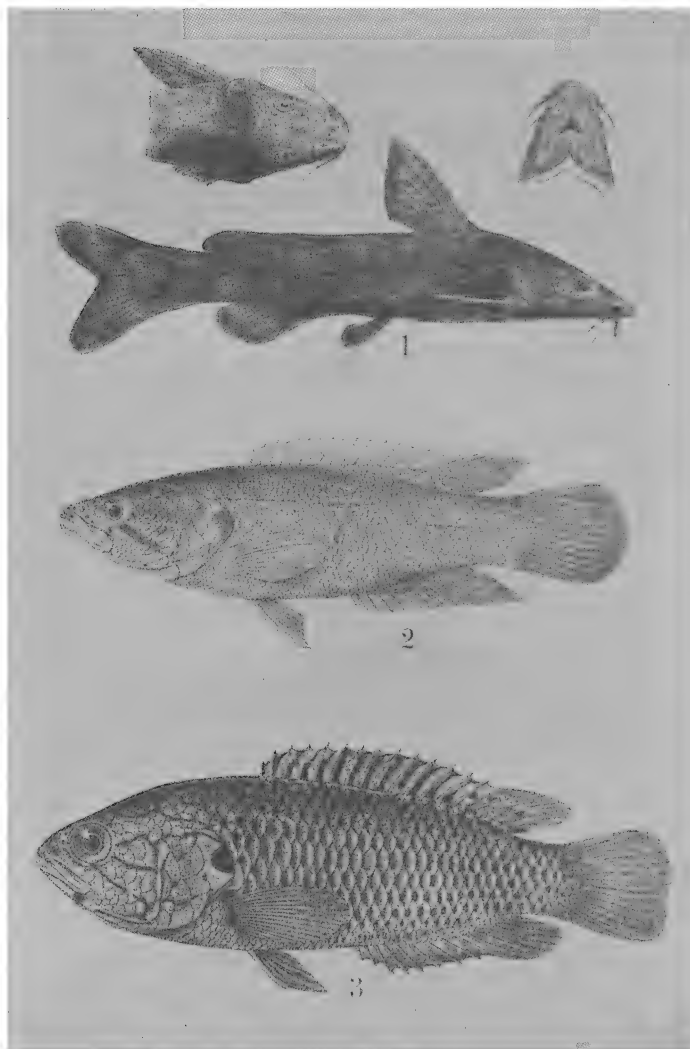
PLATE XXXII.



(From "Catalogue Fresh-Water Fishes of Africa," British Museum.)

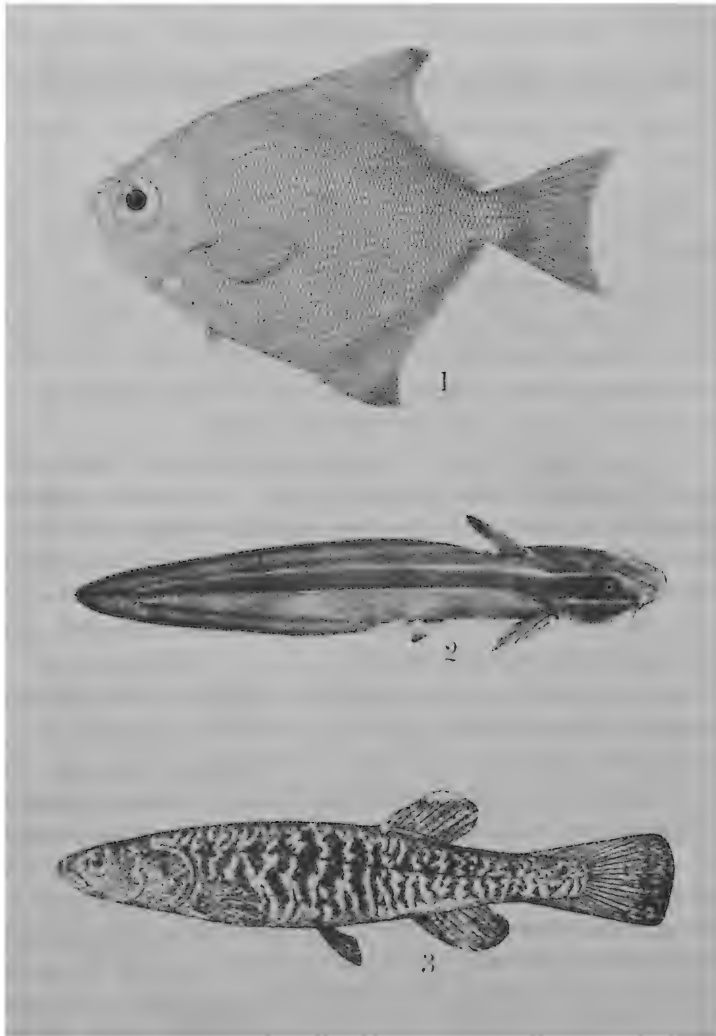
(1) *Tilapia natalensis* Weber (p. 133) "Mud-fish"; (2) *Tilapia sparrmani* Smith (p. 133); (3) *Haplochromis moffati* Cast. (p. 134).

PLATE XXXIII.



(From "Catalogue Fresh-Water Fishes of Africa," British Museum.)

(1) *Gephyroglanis sclateri* Blgr. (p. 130) "Barbel"; (2) *Anabas bairdii* Cast. (p. 135); (3) *Anabas capensis* C. & V. (p. 134) "Kurper."



(From "Catalogue Fresh-Water Fishes of Africa," British Museum.)

(1) **Monodactylus falciformis** Lacep. (p. 139) "Moony"; (2) **Plotosus anguillaris** Bleh. (p. 130) "Barbel-eel"; (3) **Galaxias zebratus** Cast. (p. 140).

Records of the Albany Museum. Vol. IV. Part II. pp. 358–364.
Pls. XL–XLII. May, 1935.

The South African Species of the Family Aluteridae.

BY J. L. B. SMITH.

[With Plates XL—XLII.]

The highly specialised Division Sclerodermi has been critically examined by comparatively few workers. The most comprehensive investigation appears to be that of Regan (Proc. Zool. Soc. Lond. 1902, vol. II, p. 284 ff.). Other works, to which I have access, deal only with regional fauna. The relationships of the various groups do not appear to be well understood, and the Division seems badly in need of revision.

Regan's classification of the groups was based chiefly upon internal features, but evidently he did not examine sufficient material to ensure that his generalisations were applicable to all the genera. At the same time, he stated that any attempt at further subdivision of the family Balistidae into new families would probably necessitate the raising of practically every genus then recognised to family rank.

In recent work on these fishes, in addition to the Balistidae, the family Monacanthidae has been generally recognised.

A graduated series of stadia of *Aluteres monoceros* Osb. has recently been obtained from South African waters, and work on this has led to a critical examination of the genus *Aluteres* Cuv. This has hitherto been accepted as falling in the Monacanthidae (or by many, Monacanthinae). While *Aluteres* has most probably originated from the Monacanthidae, the juveniles showing many typically Monacanthid features, there are nevertheless sufficient grounds to justify the separation of *Aluteres* from the Monacanthidae, with at least sub-family rank, at least as far as South African material is concerned.

Mr. Fraser-Brunner, at the British Museum, who has undertaken the much-needed revision of the whole order Plectognathi, has informed me that my conclusions are in line with those to which he had independently come, and has urged the publication of the results embodied in the present work. It is now suggested that *Aluteres* be raised to full family rank, the *Aluteridae*.

FAMILY ALUTERIDAE.

Supraclavicle vertical. Precaudal vertebrae with moderate parapophyses, without epipleurals. No epipleurals to caudal vertebrae. Prezygapophyses of the much-reduced first vertebra ankylosed with the occipital condyles. Dentary fused with articular. Premaxillae not protractile, united with maxillae. Palatines free from ectopterygoid. Preorbital ossified. Ethmoid region very elongate, without nasal cavities. Spinous dorsal of two spines, probably of secondary origin, the first weak, with posterior basal dilation: the second rudimentary, with anterior basal dilation, which can lock the first in the erect position. Soft dorsal and anal long and low. A large oblique ossified subcutaneous process in advance of the basipterygials of the soft dorsal. (Pl. XLI, b.) Pelvis represented by a single long bone, attached to the pectoral arch, more or less movable. Ventrals rudimentary, immovable, probably dermal in origin, present in juveniles as a minute stellate spine, inserted below about the middle of the pelvis: become reduced or obsolete in large adults. Compressed incisor-like teeth in both jaws. The air-bladder has on each side a sub-conical posterior process, which penetrates some distance into the caudal region.

Vertebrae 22 (7 + 15): the haemal process of the first caudal vertebra much elongated, reaching to near the ventral margin, apically dilated.

The entire absence of any trace of epipleurals, the presence of the ventral spine, and the nature of the air-bladder, do not appear to have been previously noticed, while it has hitherto been accepted that the number of vertebrae is 21.

The large ossified process immediately anterior to the basipterygials of the soft dorsal, which is present also in those species of the Balistidae and of the Monacanthidae which I have seen, is possibly the coalesced basipterygials and fin spines of an obsolete spinous dorsal.

It is noteworthy that the bases of the fin-rays of the soft dorsal and anal fins do not articulate with the apical dilations of the basipterygials, but are widely separated from these, by a

cartilaginous rod, for the entire length of each fin (Pl. 2, a). This rod is elliptical in cross-section, and has on each side, opposite each fin-ray, a groove, in which lies the muscle connecting the rays with the basipterygials. Part of the anterior end of the dorsal rod fits into a supero-posterior excavation in the ossified predorsal process described above.

The entire absence at all stadia of epipleurals,* the obsolescent ventral spine, and the peculiar structure of the hydrostatic organ, none of which is characteristic of the Balistidae or of the Monacanthidae, would appear to justify the separation of *Aluterus* from these families.

It is possible that some of the related genera, such as *Pseudaluterus*, may also be found to fall in the Aluteridae, but I have no material to determine this point.

It is noteworthy that juveniles of this family show several typical Monacanthid external features, which are partly or wholly lost or changed with growth.

Genus *Aluterus* Cuv.

1902. Regan, *loc. cit.* p. 290.

1903. Jordan and Fowler, Proc. U.S. Nat. Mus., vol. 25, p. 274 and p. 275 (*Osbeckia*).

1925. Barnard, Ann. S.A. Mus., vol. XXI, p. 960.

With the characters of the family.

Gill-rakers normal, small, lanceolate, fairly widely spaced. The skin is covered with minute close-set cilia (Pl. 3, E), so as to be soft and velvety to the touch.

Caudal rounded or truncate (adults).

The only two South African species, *monoceros* Osbeck and *scriptus* Osbeck, appear to be quite clearly congeneric. Jordan and Evermann (Check-List Fishes, 1896, p. 424, *vide* Barnard *loc. cit.*) proposed the genus *Osbeckia* for species with concave snout profile and caudal longer than head. These slender distinctions, especially in view of the evidence here adduced, are inadmissible as of generic significance.

* It may be remarked that in one case a single presumed epipleural to the 5th precaudal vertebra was found on one side only.

In so far as can be determined, both species are valid. They are so closely related, especially in the juvenile stadia, that the possibility of sexual dimorphism might be suspected. I have no sexually mature adults of either species, but in so far as I have been able to determine, among the adults of *monoceros* which I have examined are males and females, so that both species may be accepted.

Numerous nominal species of *Aluterus* have been described, but many of these are obviously merely different growth stadia.

In the case of *monoceros* at least, there is very considerable change in general features with growth, as will be described below. In the case of *scriptus*, these cannot be described, since I have seen only one specimen, but there is reason for presuming that at least similar growth changes occur in this species (*vide infra*).

KEY TO THE SOUTH AFRICAN SPECIES.

- I. Caudal not longer than head; rounded or truncate (adult) *monoceros*.
- II. Caudal longer than head, rounded *scriptus*.
Aluterus monoceros Osb. (Pls. XL—XLII.)
- ? *Cantor, Cat. Mal. Fish, p. 353 (*obliteratus*).

1888. Day, Fishes of India, p. 693. Pl. CLXXIX, fig. 2 (synonymy).

1903. Jordan and Fowler, *loc. cit.*, p. 274.

1925. Barnard, *loc. cit.*, p. 960.

1928. Fowler, Fishes Oceania, p. 461.

This species has so often been described that repetition of the obvious features is unnecessary. The more unusual features and the growth changes are described below.

The following table indicates the change with growth of certain of the dimensional relationships.

Length, mm.	..	..	63.	95.	123.	135.	300.	595.
Depth in length of body	2.4	2.4	2.4	2.6	2.9	3.3		
Eye in head..	..	..	4.0	5.0	5.0	5.0	6.0	6.5
Caudal in head	..	..	—	1.3	1.4	1.7	2.0	2.6

* I have received a copy of this description from Mr. Norman, of the British Museum.

The chief growth changes are the following:—

Shape of body: In the very young the body is fairly deep, with the greatest depth across the shoulder. The breast is strongly convex. The body tapers more or less uniformly from the head to the caudal. With growth, the convexity of the breast becomes less, till in old adults there is a marked angle below the chin at the breast. The cuneate shape is modified in that the body becomes deeper posteriorly, until it is about of even depth from the first to the second dorsal. (Pl. XL, A-D.)

Dorsal spine: In the young the first spine is relatively more elongate, and has four series of fairly large barbs (Pl. XLII, C). With growth the spine becomes relatively shorter, more slender, and the barbs degenerate into granulations. This spine is frequently deformed.

Caudal fin: In the young the fin is relatively more elongate and strongly rounded. With growth, the fin becomes shorter, and the hind margin less convex, until finally the truncate fin of the adult results.

Ventral spine: In the very young the ventral spine is fairly prominent, stellate (Pl. XLII, D). With growth, the apical projections diminish, until in adults the whole is reduced to a minute more or less translucent knob, which can nearly always be located by loosening the skin of the hinder third of the pelvis and viewing against a light. In the very smallest specimens there appear to be signs of some connection between the base of the spine and the pelvis, but in all the other stadia, it is unquestionably dermal. The significance of the dermal origin of the spine was pointed out to me by Mr. Fraser-Brunner, who is dealing fully with the matter.

Profile of snout: In the young the dorsal profile of the snout is fairly concave. With growth, the concavity lessens, until in large adults the profile is convex.

Gill-rakers 22-25 on the lower part of the anterior arch, about 6 in gill-filaments, which are rather longer than the eye.

The dorsal originates opposite or behind the anal.

This species occurs on our coasts from the Cape eastwards. I have seen specimens from the Cape; Mossel Bay; Knysna;

Port Alfred: Great Fish Point; East London; Durban, and Delagoa Bay.

Aluterus scriptus Osb. (Pl. XLII, A.)

1888. Day, *loc. cit.*, p. 694. Pl. CLXXX, fig. 3.

1903. Jordan and Fowler, *loc. cit.*, p. 276 (*Osbeckia scriptus*).

1925. Barnard, *loc. cit.*, p. 961.

1928. Fowler, *loc. cit.*, p. 461. Pl. XLVII, B.

I have seen only one specimen of this species, 113 mm. in length, from Durban. From this, and from figures, it would appear that growth changes occur also in this species.

In the juveniles, the maximum depth is through the breast, which is strongly convex. This convexity apparently diminishes with growth, although the body does not appear to lose the uniform tapering from the first dorsal to the caudal.

The caudal apparently always remains rounded and longer than the head (1.2 times head), and the dorsal profile of the snout is always concave.

At equivalent stadia, the body is always less deep than that of *monoceros*.

The ventral spine resembles that of *monoceros*. The dorsal spine in my specimen (Pl. XLII, B) shows minute barbs set among granulations. In my specimen, the dorsal originates in advance of the anal.

Gill-rakers 28 on the lower part of the anterior arch, about 4 in gill-filaments, which are equal to the eye.

This species is very seldom encountered on our shores.

I wish to express my gratitude to the Carnegie Research Fund (through the Research Grant Board of South Africa) for financial assistance, which has defrayed a great part of the costs incurred in the investigation. Also to Dr. J. A. Wain of Cathcart, for numerous radiographs.

Plate XL.

Four stadia of *Aluterus monoceros* Osb. The small arrow indicates the position of the ventral spine.

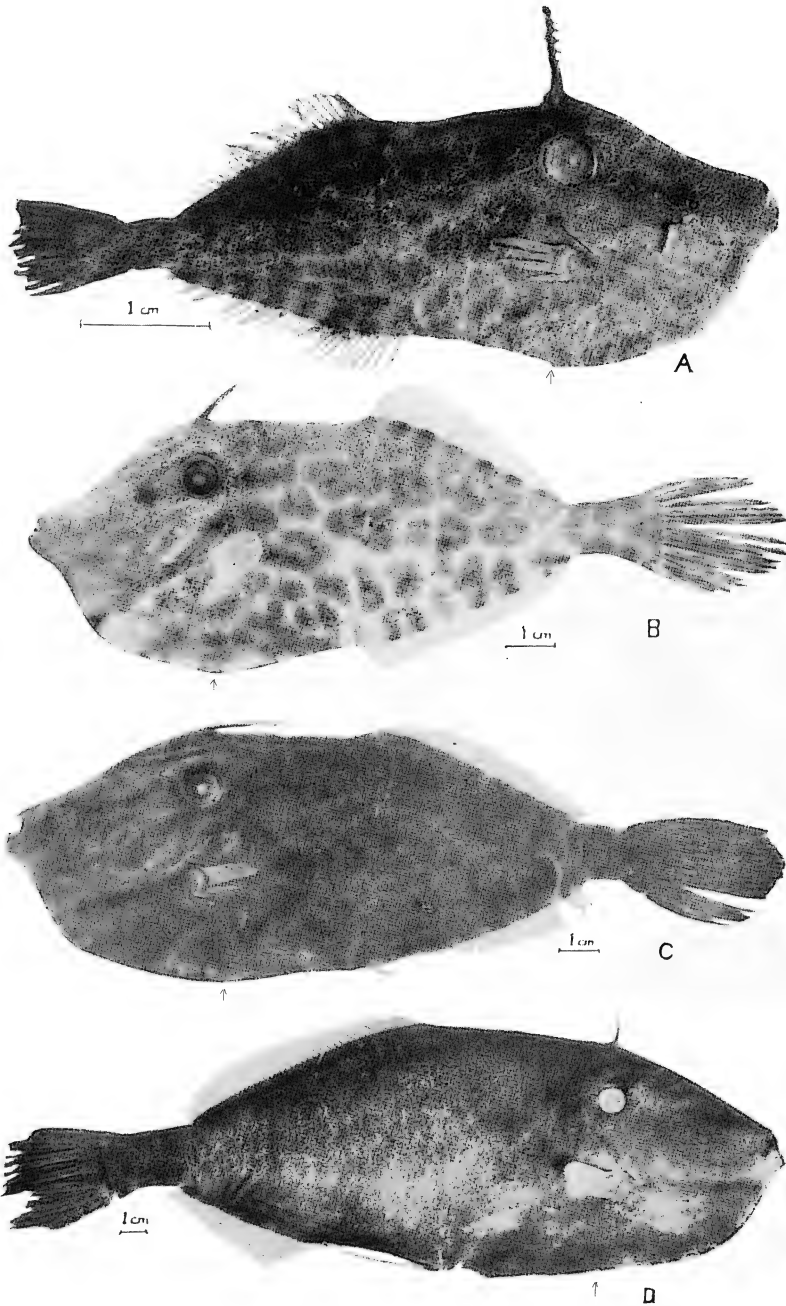
Plate XLI.

Aluterus monoceros Osb. Radiograph.

- a. Cartilaginous rod between fin-rays and basipterygials.
- b. Predorsal process.

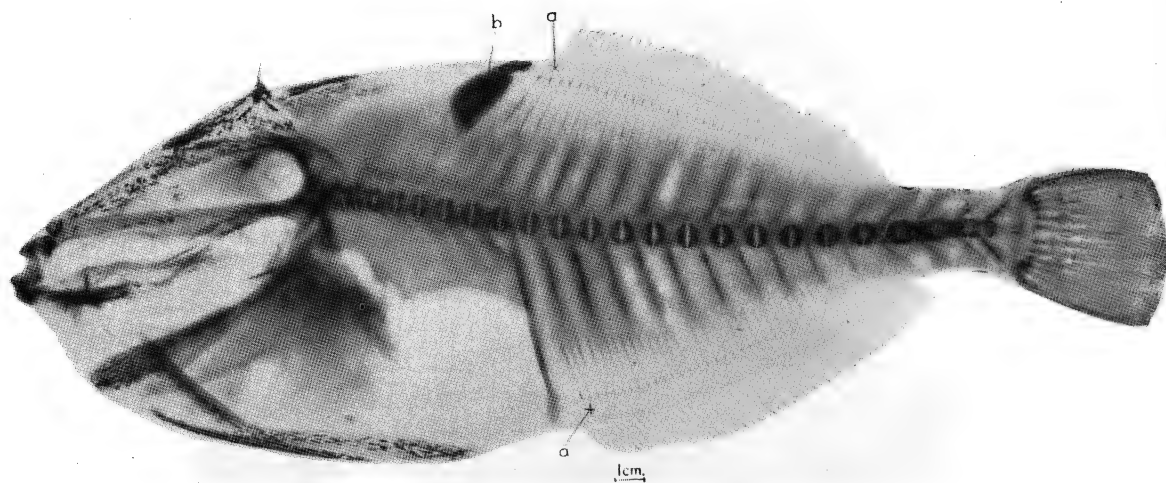
Plate XLII.

- A. *Aluterus scriptus* Osb. The arrow indicates the position of the ventral spine.
- B. First dorsal of same; enlarged.
 - b. second spine.
- C. First dorsal of a juvenile *Aluterus monoceros* Osb.
 - a. second spine.
- D. Ventral spine of same specimen (135 mm. in length). Posterior margin to the right.
- E. Portion of skin of the same specimen, showing cilia.



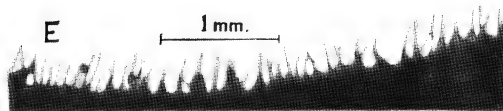
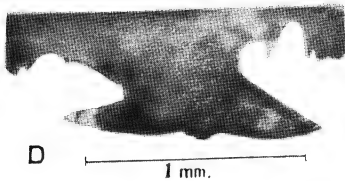
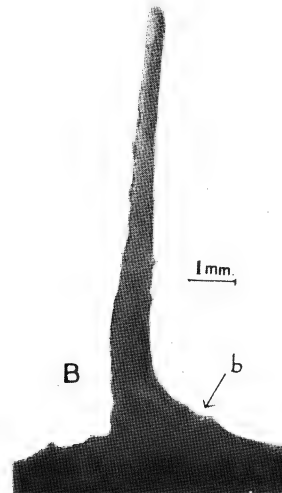
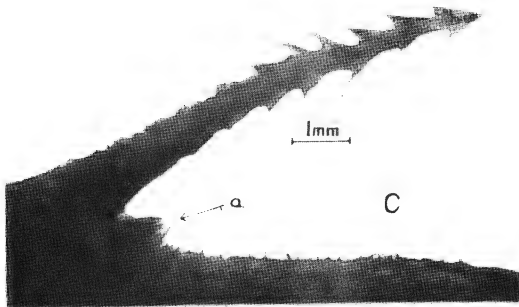
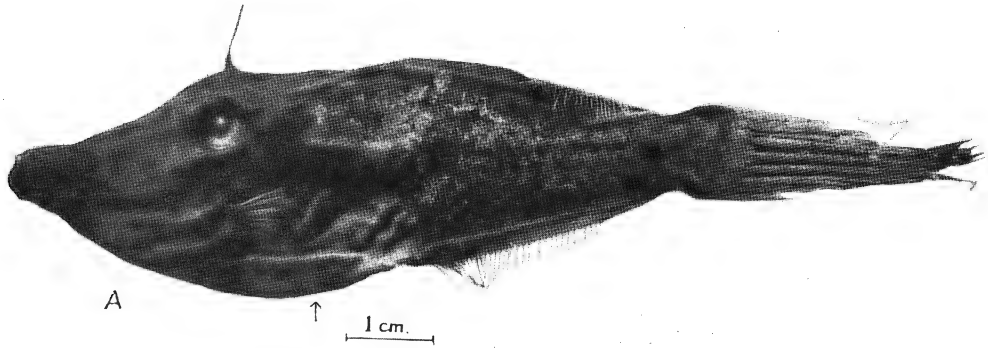
Aluterus monoceros Osb.

(The small arrow indicates the ventral spine.)



Aluterus monoceros Osb.

- a. Cartilaginous rod below dorsal and anal.
- b. Ossified predorsal process.



A. *Aluteres scriptus* Osb.
C. *Aluteres monoceros* Osb. Dorsal spine.

B. Dorsal spine of same.
D. Ventral spine. E. Portion of skin.

Transactions of the Royal Society of South Africa. Vol. XXIII.
Part IV. pp. 303–310. Pls. XXI–XXIII. February, 1936.

THE GENUS *TRIPTERODON* PLAYFAIR.

By J. L. B. SMITH.

(With Plates XXI–XXIII and one Text-figure.)

(Read June 19, 1935.)

The genus *Tripterodon* Plyfr. with the single African species *orbis* Plyfr. has hitherto not received more than brief attention, and the features which would indicate its taxonomic relationships do not appear to have been investigated in any detail.

A careful examination of the skeletal and structural features of this genus has led to a comparison with the same features in the obviously related genera *Platax* Cuv. and *Drepane* Cuv.; with these is allied *Ephippus* Cuv. It has not been possible to obtain a specimen of the latter for dissection, but it is obvious from accounts dealing with the internal structure, as well as from the external features in a specimen examined, that this genus and the three others mentioned form a natural group.

Although *Platax*, *Ephippus*, and *Drepane* are among the earliest described genera of fishes, there is some diversity of opinion among systematists as to their taxonomic relationships. Regan (Ann. Mag. Nat. Hist., 1913 (8), vol. xii, p. 127), who based his opinions chiefly upon skeletal features, placed *Platax* with *Ephippus* in the **Ephippidae**, and separated *Drepane* as the type of the family **Drepanidae**; in this latter case he has not given any detailed reasons for his conclusion beyond that *Drepane* has no subocular shelf, while stating that in all other skeletal features the two families are identical. *Platax*, with a feeble subocular shelf, in this respect falls midway between *Drepane* and *Ephippus*, the latter having a strong shelf.

Barnard (Ann. S.A. Mus., 1927, vol. xxi, pp. 600 and 605) followed Regan's classification.

Fowler (Proc. Ac. Nat. Sci. Phil., 1925, vol. lxxvii, p. 251) at first accepted Regan's classification for *Drepane*, but has more recently (Bull. U.S. Nat. Mus., 1929, vol. viii, p. 25; and Proc. Ac. Nat. Sci. Phil., 1934, vol. lxxxvi, p. 479) accorded *Drepane* only sub-family rank in the **Ephippidae**, while separating *Platax* as a monotypic family. In the absence of more precise reasons, based on skeletal data, for the recognition of the **Drepanidae**

by Regan, Fowler's later classification, although obviously based on external features only, might appear almost justifiable.

The genus *Tripterodon* Plyfr. has been somewhat arbitrarily placed in various families. Fowler (Proc. Ac. Nat. Sci. Phil., 1925, vol. lxxvii, p. 242; and Bull. U.S. Nat. Mus., 1933, vol. xii, p. 202) placed *Tripterodon* in the **Girellidae**, whereas more recently (Proc. Ac. Nat. Sci. Phil., 1934, vol. lxxxvi, p. 478) he has described the single species of that genus as a *Chaetodipterus* Lac., placed with *Drepane* in the **Ephippidae**, and has thus indirectly recognised that *Tripterodon* is closely related to *Ephippus* and to *Drepane*. Barnard (*loc. cit.*, p. 725) placed *Tripterodon* in the **Sparidae**, and also confused *Tripterodon* with *Chaetodipterus* (*loc. cit.*, pp. 603, 604) by accepting what have proved to be somewhat excusable malidentifications by earlier workers on South African fishes.

Examination has shown that the inclusion of *Tripterodon* in the **Girellidae** has little to recommend it. Fowler has probably regarded the dentition as a feature of paramount significance, but there is little else in common and so much divergence in important features that this diagnosis cannot be accepted.

In the majority of skeletal features which systematists have hitherto regarded as of chief significance, the four genera *Platax*, *Ephippus*, *Tripterodon*, and *Drepane* are so closely allied that they might easily be regarded as all falling within one family. Nevertheless *Drepane* is distinguished by several features, notably the structure of the upper jaw, which, although apparently not regarded as important by earlier workers, would appear to justify separation from the remaining three genera by full family rank. According to the degree of taxonomic significance assigned to these special characteristics of *Drepane* it is not even unlikely that the **Drepanidae** may ultimately be raised to the rank of a division, with probable inclusion of the **Chaetodontidae**.

With regard to the classification of the remaining three genera there are several alternatives, but the selection of any one of these will very largely depend upon the personal interpretation of the taxonomic significance of the relatively few features in which these genera differ one from the other. They may be regarded as each forming the type of a separate family, although the separation of *Platax* from the remaining two, as proposed by Fowler (*loc. cit.*), merely upon the somewhat abnormal external features of that genus, does not appear to be justified, and is not accepted here. Should, however, this distinction for *Platax* otherwise meet with general approval, *Tripterodon* would then appear to have at least equal claims to recognition as the type of a separate family. It may here be indicated that Fowler's key to the genera of the **Ephippidae** (Bull. U.S. Nat. Mus., 1929, vol. viii, p. 24) does not agree with his diagnosis of the family.

The strong subocular shelf and the setiform dentition are distinctive characters which might reasonably be regarded as justifying full family rank for *Ephippus* as opposed to the closely related *Platax* and *Tripteron*. Nevertheless, when all the available evidence is carefully weighed, it appears to be more in keeping with generally accepted limits to adopt the classification here proposed, *i.e.* in view of the general agreement in the majority of important features, the genera *Platax*, *Ephippus*, and *Tripteron* be placed in a single family, the **Platacidae**.* The special features of *Ephippus* are then assigned only sub-family rank, while *Platax* and *Tripteron* are placed together in the sub-family **Platacinae**, as arranged below in the key to the genera of the family **Platacidae**.

The following summary indicates the main features in which the **Drepanidae** may be regarded as well distinguished from the **Platacidae**.

- I. Anterior maxillary processes produced, meeting beneath the anterior margin of the mesethmoid, over the premaxillary pedicels. Premaxillaries slender, highly expanded distally above and below. Premaxillary pedicels very long, oblique, entering the skull beneath the olfactory sacs, sliding in a deep excavation extending between the lower orbital margins. Posterior ribs extensively articulated with the parapophyses. Gill-membranes narrowly fused with isthmus. Pectorals much longer than head. Scales cycloid. (Caudal more or less rounded) **Drepanidae**.
- II. Maxillaries normal, not meeting anteriorly over the premaxillary pedicels. Premaxillaries not or scarcely expanded distally: Premaxillary pedicels not penetrating the skull, entirely anterior to the orbital margins, sub-vertical. Posterior ribs not or scarcely articulated with the parapophyses. Gill-membranes broadly fused with isthmus. Pectorals shorter than head. Scales ctenoid. (Caudal truncate or nearly so) **Platacidae**.

In most other respects the families agree.

The curious shape and disposition of the premaxillaries of the **Drepanidae** reveal the connection between that family and the **Chaetodontidae**. In the latter, although the premaxillary pedicels are fairly short, they are very oblique, and penetrate below the olfactory sacs. In *Chaetodon setifer* Blech. there does not appear to be the extensive articulation of the ribs with the parapophyses indicated by Regan (*loc. cit.*) as characteristic of the family.

It has earlier been indicated (Smith, Proc. Roy. Soc. S.A., 1935, vol. xxiii, p. 267) that the genus *Dichistius* Gill. reveals affinities with the **Platacidae**, and connects that family with the natural group of the **Scorpididae** and the **Kyphosidae**.

* *Platax* (Cuv. Reg. Anim., 1817, vol. ii, p. 334) has page preference over *Ephippus* (*ibid.*, p. 335), and should therefore determine the name of the family.

FAMILY PLATACIDAE.

Body compressed, elevated or ovate. Front profile steep. Mouth terminal, small, moderately or scarcely protractile, more or less horizontal. Maxillary moderate, without anterior forward expansion. Premaxillary pedicels fairly long. Jaws with bands of movable teeth, slender and setiform, or compressed and notched. Palate edentate, vomer sometimes feebly dentate. Preopercle not, finely, or coarsely, serrate (spinose in young?). Gill-membranes united, broadly fused with isthmus, openings lateral. Gill-rakers short, few. Branchiostegals 6 (or 7?).

Dorsal long, of a few spines, soft dorsal longer than spinous. Soft fin scaly. Below the skin a stout antrorse procumbent spine, fused with the basipterygial of the first two exposed spines; anterior to this, three obsolescent antrorse spines, the anterior (inferior) overlapping the supraoccipital apex (Pl. XXII).

Anal of three spines, with small antrorse recumbent spine on anterior basipterygial; soft fin scaly. Pectorals short. Ventrals fairly or very long, with axillary process. Caudal of 17 principal rays, of more or less truncated form. Scales ctenoid, small or moderate. Lateral line gently curved.

Vertebrae 24 (10 + 14), with parapophyses from the 4th. Anterior ribs expanded proximally. An elevated occipital crest, anterior margin expanded. No parietal crests. Subocular shelf feeble or strong. Air-bladder posteriorly bifurcated into two caudal prolongations (Pl. XXIII).

The three genera here mentioned occur in the Indo-Pacific.

Key to the Genera.

- I. **Ephippinae**.—Subocular shelf strong. Teeth setiform. (Scales fairly large) *Ephippus*.
- II. **Platacinae**.—Subocular shelf very feeble. Teeth compressed, tricuspid. (Scales moderate or small.)
 - A. Dorsal spines graduated, none longer than longest soft rays. More than 50 series of scales. Preorbital not very deep. Premaxillary pedicels shorter than rami *Platax*.
 - B. 3rd–5th dorsal spines elongate, longest longer than posterior spines and than longest soft rays. Less than 50 series of scales. Preorbital very deep. Premaxillary pedicels as long as rami *Tripteron*.

Genus EPHIPPUS Cuv.

I have seen only a single specimen of the species *orbis* Bloch, from India. This has not yet been found in the South African region, but will probably be discovered there with more intensive collecting. It occurs in the Indian region, but appears to be nowhere very plentiful.

In external form, chiefly in the shape of the fins, this species resembles *Tripteron orbis* Plyfr. closely, but has a shallower preorbital and the body is more uniformly orbicular, while the setiform teeth are immediately diagnostic. As is shown below, the species *goreensis* C. and V. from the West Coast of Africa shows even more remarkable resemblance to *T. orbis* in external form.

The Genus Tripteron Playfair.

307

Genus PLATAX Cuv.

Premaxillary pedicels short, almost vertical. Supraoccipital and anterior dorsal basipterygial becoming greatly enlarged with age. Preopercle margin entire in adult. Sometimes a few fine teeth on vomer. Teeth rather slender, but apically somewhat dilated and sharply tricuspid.

On casual examination the teeth appear setiform. The dentition in this genus is intermediate in form between that of *Ephippus* and that of *Tripteron*.

Fowler (Bull. U.S. Nat. Mus., 1929, vol. viii, p. 17) has stated that the air-bladder is simple. In those specimens I have examined the air-bladder has a median longitudinal septum, and is bifurcated into two caudal extensions, which are more pronounced in large specimens.

There appear to be fairly extensive growth changes and many nominal species have been proposed, but the majority of recent workers appear to accept only two, *pinnatus* Linn. (*teira* Cuv.=) and *orbicularis* Bloch (*vespertilio* Cuv.=). Diagnoses of these species do not always agree, and there appears to be some confusion with regard to the features upon which differentiation is based.

As far as South African material is concerned, positive identification with either species, *i.e.* if both are recognised, is difficult.

It would appear not unlikely that there is but a single rather polymorphous species, though I have not sufficient material to enable me to decide this.

Genus TRIPTERODON Plyfr.

1866. Playfair, Fishes of Zanzibar, p. 42.

1927. Barnard, *loc. cit.*, p. 725.

1933. Fowler, Bull. U.S. Nat. Mus., vol. xii, p. 202.

Premaxillary pedicels as long as rami, but not reaching frontals, almost vertical; superior lateral processes very small. Maxillaries normal, short and deep, moderately expanded distally. Subocular shelf extremely feeble, merely a slight pointed downward expansion of the second suborbital.

Vertebrae 24 (10 + 14), first very much reduced, not ankylosed with the skull. Parapophyses from the fourth precaudal. Ribs all sessile. Epipleurals extremely fine, hair-like. Haemal spines of anterior caudal vertebrae with median longitudinal expansion below the extensions of the air-bladder (Pls. XXII and XXIII). Post-temporal forked, not ankylosed. Post-clavicle long and slender. Pectoral radials 5, upper three bobbin-shaped, only the lowest (5th) abutting on the coracoid (fig. 1).

Branchiostegals 6. Pseudobranchiae absent (concealed). Teeth very compressed, slightly recurved, tricuspid. Pyloric caeca few (3-4).

Other characters as outlined for the family.

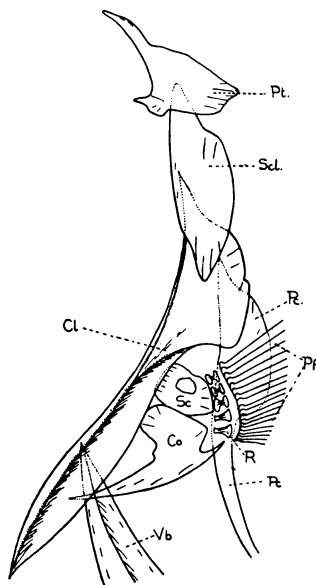
At present only a single species, *orbis* Plyfr., is known from the east coast of Africa.

Tripteron orbis Plyfr.

(Pls. XXI-XXIII)

Tripteron orbis Plyfr., Playfair, *loc. cit.*, p. 42, pl. vii, fig. 1. Fowler, Proc. Ac. Nat. Sci. Phil., 1925, vol. lxxvii, p. 242; and 1933, *loc. cit.*, p. 202. Smith, Rec. Albany Mus., 1935, vol. iv, p. 209.*

Chaetodipterus orbis (non Bloch), Norman, Ann. Mag. Nat. Hist., 1922 (9), vol. ix, p. 321 (record only, error in Brit. Mus. Register).†



TEXT-FIG. 1.—Left pectoral girdle of *Tripteron orbis* Plyfr. showing orientation of ventral basipterygium.

Cl., cleithrum; *Co.*, coracoid; *Pc.*, post-clavicle; *Pf.*, pectoral fin; *Pt.*, post-temporal; *R.*, radial; *Sc.*, scapula; *Scl.*, supracleithrum; *Vb.*, ventral basipterygium.

Chaetodipterus goreensis (non C. and V.), Barnard, *loc. cit.*, p. 603. Fowler, Proc. Ac. Nat. Sci. Phil., 1934, vol. lxxxvi, p. 478, fig. 43.

Body more or less orbicular, more angular in adults, fairly compressed. Dorsal profile very elevated, slightly undulate, with moderate interorbital prominence, which increases with age.

Depth 1.2–1.4, length of head 3.0–3.2 in length of body. Eye 2.7–3.7 (Ad.), snout 1.6 (Ad)–1.8, interorbital 2.7–3.2 and postorbital 3.5–4.0 in length of head. Least depth of preorbital 1.0 (Juv.)–1.4 times eye.

Nostrils wide apart, anterior rounded, posterior long and oval. Mouth horizontal, small, terminal, only slightly protractile. Maxilla extends to below anterior nostril.

* In this paper *Chaetodipterus orbis* Bloch, recorded by Barnard, *loc. cit.*, p. 604, has erroneously been included in the synonymy of *T. orbis*; actually this author had merely accepted the British Museum record.

† Private communication from Mr. J. R. Norman.

The Genus Tripteron Playfair.

309

Lips thick, especially upper, which is $\frac{1}{2}$ eye deep at snout tip. All the teeth movable compressed tricuspid incisiform, in about 4 rows, the outer of 18–20 teeth in each jaw: the inner teeth embedded in fleshy pads.

Palate and tongue edentate. Gill-membranes broadly fused with isthmus. Gill-rakers 9–10, short, about 4–5 in gill-filaments, which are $1\frac{1}{3}$ – $1\frac{1}{2}$ in eye. Preopercle serrations more marked in juveniles.

D IX, 19–21, originates above hind margin of opercle. First spine very short; second twice the first; third 1.5–2.2 (Juv.); fourth 1.3–2.0 (Juv.); fifth 1.0–1.2 times head; remainder short, about equal to eye. Soft rays abruptly longer than last spine, 6th–8th longest, 1.1–1.4 in head. Scaling on soft fin very dense at base. Base of spinous dorsal about as long as head, of soft dorsal 1.4–1.5 times head.

A III, 16–17, spines fairly short and stout, second longest. Anterior rays longest, 1.2–1.4 in head, edge of fin almost straight.

Pectorals rounded, 1.2–1.6 (Ad.) in head.

Ventrals 1.0–1.6 (Juv.) times head, first ray filamentous.

Caudal with hind margin gently undulate, with median convexity. Least depth of peduncle about 2.6 in head.

Scales ctenoid (Pl. XXIII), lateral line scales smaller than adjoining scales but not hidden (Pl. XXIII), l.l. 43–45, l.tr. $\frac{12-13}{23-24}$ (origin of first dorsal spine back), 7 series on cheek, not much smaller than opercular scales.

Colour: Silvery brown, with dark cross-bars of varying width, first from nape through eye to chest, second from before dorsal origin, thereafter 3 pairs alternately narrow and wide, and ninth bar indistinct on peduncle. Bars generally narrower than interspace. Snout dark. Spinous dorsal, ventral, and anterior portion of soft dorsal and anal, black. Pectorals light, dark base. Soft dorsal and anal and caudal with obscure series of dark spots.

Length.—Up to 300 mm. (Playfair).

Locality.—Durban, Delagoa Bay, Zanzibar.

Seven specimens, from 97–215 mm. in length, examined.

A very characteristic species, easily recognised by the shape of the body and fins, by the restricted gill-openings, and by the apically brown, strongly tricuspid teeth.

It is not remarkable that this species has been confused with *Chaetodipterus goreensis* C. and V. (Cuvier and Valenciennes, *Hist. Nat. Poiss.*, 1831, vol. vii, p. 125, pl. 178), for in general external features the two species resemble one another so closely that only detailed comparison could show the difference between them.

In so far as may be judged from the description of the type of *goreensis* (an adult) the sole external difference of any significance between that species and *Tripteron orbis* is in the dentition, the former having typical brush-like setiform teeth. Besides this the preorbital in *goreensis* does not appear to be as deep as in *orbis*, while C. and V.'s figure shows the cheek scales to be very much smaller than those on the opercle, which is not the case in *orbis*, the 3rd and 5th dorsal spines not filamentous, and the upper lip not as deep as it is in *orbis*.

A later description of *goreensis* by Pellegrin (Ann. Inst. Ocean., 1914, vol. vi, p. 55, figs. 7 and 8) does not mention the dentition, shows the preorbital to be deeper, and the 3rd-5th dorsal spines to be short in the juvenile and elongate and filamentous in the adult stage, which latter growth change appears rather exceptional.

So similar are *goreensis* and *orbis* that, had Cuvier not made the positive statement about the setiform dentition of the former, I should have had little hesitation in regarding the two as conspecific, for the remaining differences are unimportant, and the conflicting statements about the lengths of the 3rd-5th dorsal spines may probably be attributed to accidental shortening of the fragile filamentous extensions of these spines.

In so far as my specimens are concerned, the chief growth changes observable are that the preorbital becomes markedly deeper, the inter-orbital convexity greater, the 3rd-5th dorsal spines shorter, and the ventrals shorter with increase in size of the fish. In juveniles the ventrals reach well along the base of the soft anal, in adults barely beyond the origin of the spinous fin. I have not seen any very young specimens.

A re-examination of the type of *goreensis* might be of interest.

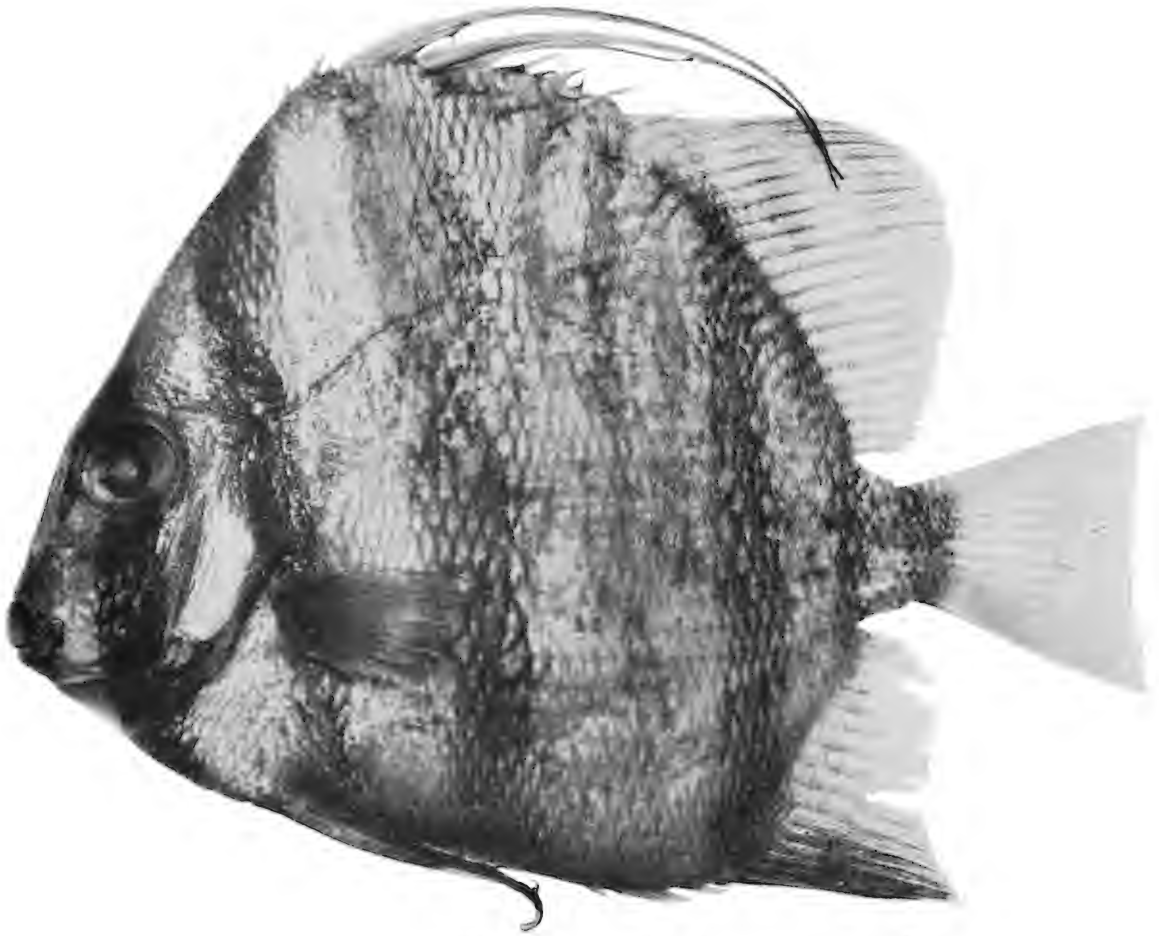
Fowler's specimen described as *goreensis* (*loc. cit.*) might be either that species or *orbis*, since he does not mention the nature of the dentition. There is, however, little doubt that the specimen is conspecific with *orbis* as here accepted. In the description Fowler stated that the 4th dorsal spine varies from 1.6-2.3 in length of body, whereas in the figure it is shown to be much shorter, about 3. Also the shape of the anal fin in the figure agrees neither with that shown for *goreensis* (C. and V., *loc. cit.*, and Pellegrin, *loc. cit.*) nor with that of my specimens of *orbis*.

T. orbis is only an occasional capture in the nets at Durban, and is apparently hardly ever encountered during the winter months. There appears to be no record of its occurrence any distance south of Durban. I have recently received a large collection of representative fishes from the coast of Tanganyika Territory (collected during the summer months), and since *orbis* was not among them it may be concluded that it is not abundant even in the neighbourhood of the type locality.

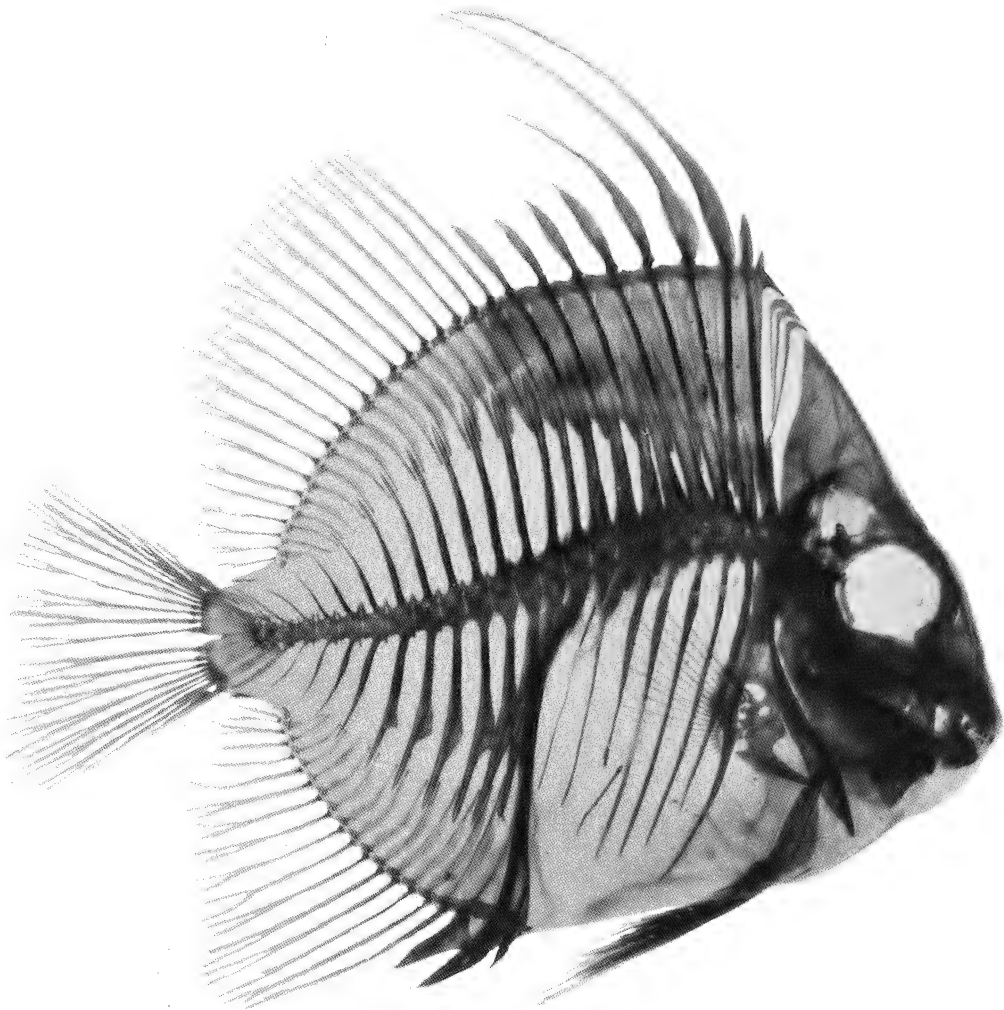
Nothing is known of the habits of this species, but they probably resemble those of *Platax* and *Drepane*, and it probably lives chiefly among reefs. None of the specimens I have examined have been sexually mature.

I wish to express my gratitude to Dr. Barnard, Assistant Director of the South African Museum, for the loan of material and literature. Also to the Carnegie Research Fund (through the Research Grant Board of South Africa) for generous financial assistance.

ALBANY MUSEUM,
GRAHAMSTOWN,
May 1935.

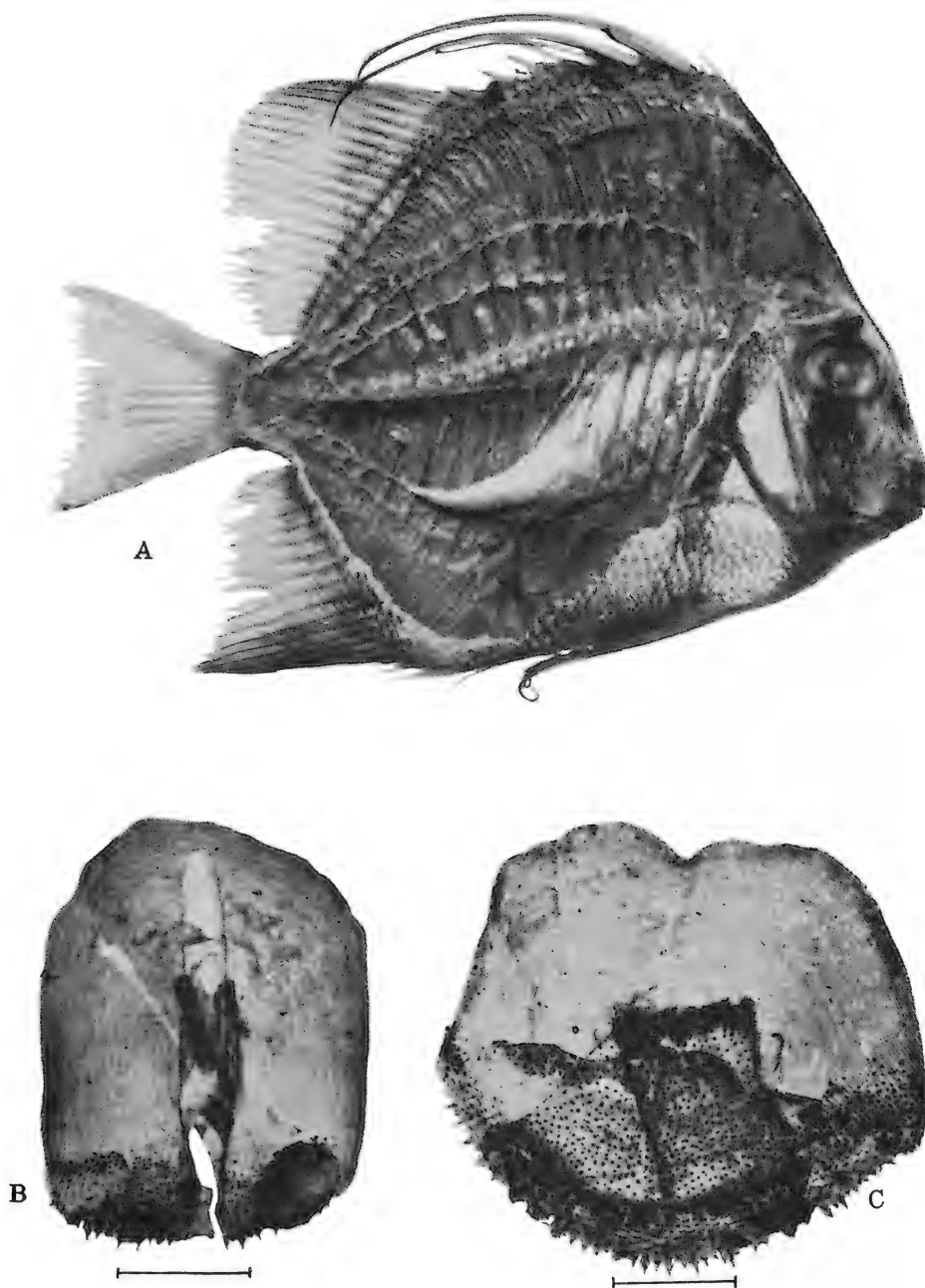


Tripteron orbis Plyfr. $\times 1\frac{1}{2}$.



Tripterodon orbis Plyfr. $\times 1\frac{1}{3}$.

Stained and cleared specimen showing skeleton, with upper half of the paired structures removed.



Tripterodon orbis Plyfr.

A. Showing structure of air-bladder. B. 7th lateral line scale. C. Scale above lateral line below spinous dorsal. Scales from specimen 185 mm. in length. The lines below B and C represent 1 mm.

Smith.

Neill & Co., Ltd.

Transactions of the Royal Society of South Africa. Vol. XXIV.
Part I. pp. 1–6. Pls. I and II. June, 1936.

TWO INTERESTING NEW FISHES FROM SOUTH AFRICA.*

By J. L. B. SMITH.

(With Plates I and II, and two Text-figures.)

(Read September 18, 1935.)

Family SCYMNORHINIDAE.

Regan (Ann. Mag. Nat. Hist., 1908 (8), vol. ii, p. 40) defined the family SQUALIDAE so widely as to include even genera such as *Pristiophorus* M & H, which are to-day generally accorded full family rank. *Scymnorhinus* Bonap. and *Echinorhinus* Blnv., and their relatives, without fin-spines, appear to merit family distinction from the SQUALIDAE. Actually certain authorities favour even recognition of the families ECHINORHINIDAE and SCYMNORHINIDAE as distinct one from the other. Although this appears to set rather narrow limits for family distinction, it is accepted here.

Scymnorhinus Bonap. replaces *Scymnus* Cuv., preoccupied (Kugelman 1814, a genus of Beetles). These two genera are sometimes accepted as synonyms of *Dalatias* Raf. (1810), but according to Jordan and Evermann (The Genera of Fishes, 1917, p. 97) this is not established, and is not accepted here.

Scymnorhinus has not previously been recorded from South Africa. A new species of that genus is described below.

Scymnorhinus brevipinnis n. sp.

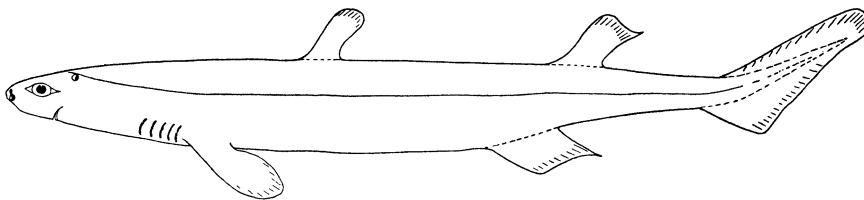
No anal fin, no fin-spines, no nictitating membrane.

Greatest depth of body 9–10 in total length. First gill-slit about midway between tip of snout and origin of first dorsal. Longitudinal diameter of orbit 7·5–8·5, vertical diameter 19–22, prespiracular distance 4·5, preoral length 6·2–6·4, width of mouth 6·0–6·3 in distance from tip of snout to origin of first dorsal. Inner internasal distance 1·8 in preoral length. Interspiracular distance 1·5 in prespiracular length.

Mouth transverse, lower lip thick, no labial folds. A straight longitudinal groove from each corner of mouth. 19 compressed triangular teeth in lower jaw. The central (anterior) tooth erect, the remainder oblique,

* The Council desires to acknowledge the receipt of a grant from the Carnegie Corporation through the Research Grant Board towards the cost of printing this paper.

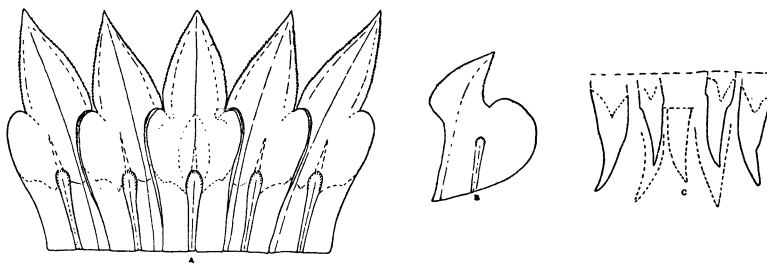
increasingly so posteriorly. Edges serrate, 19–26 fine serrae on each edge (fig. 2). Behind the single row of functioning teeth are four overlapping rows of inwardly depressed teeth in succession. 19 series of teeth in upper jaw, narrow and pointed: central tooth almost vertical, remainder oblique,



TEXT-FIG. 1.—*Scymnorhinus brevipinnis* n. sp. (type). ($\times \frac{1}{4}$.)

edges entire. The second row close behind the first, and behind these three more rows in succession.

First dorsal inserted midway between origin of second dorsal and hind margin of eye, 2.2–2.3 times nearer origin of pectorals than origin of second dorsal, 1.7 times than origin of ventrals, and twice as far from hind margin of caudal as from snout tip. Second dorsal 1.2 times further from hind



TEXT-FIG. 2.—Dentition of *Scymnorhinus brevipinnis* n. sp.

- A. Anterior teeth of lower jaw. B. Posterior tooth of same.
C. Anterior teeth of upper jaw; those in second row with interrupted outline.
(All $\times 2.3$.)

margin of caudal than from origin of first dorsal. Three-quarters of ventral base in advance of second dorsal. First dorsal about as long as second, slightly less than prepiracular length. Base of first dorsal 1.5, base of second dorsal 1.2 in length of first dorsal. Length of ventrals 1.3 in, base of ventrals 1.3 times, length of first dorsal. Pectorals 1.3–1.4 times length of first dorsal.

Depth of gill-openings about equal to longitudinal diameter of eye. Nostrils more or less rounded, separated, no cirri or oronasal grooves. A slight depression in lower surface of snout between nostrils. Spiracles large.

Two Interesting New Fishes from South Africa

3

Caudal lobes small: greatest transaxial width of caudal fin scarcely greater than prepiracular length.

The whole body and head covered with small scales, each more or less quadrate, having a dorsal ridge terminating in a stout spine, usually also one or two minute basal spines.

Colour.—Uniform dark brown, slightly lighter below. Tips of fins slightly lighter.

Length.—770–1100 mm.

Holotype in the Albany Museum.

Three specimens examined.

These interesting fishes were taken by the trawler "Algoa Bay" at a depth of 110–150 fathoms, some 35 miles south of Cape Recife, about 34° 32' S., 25° 42' E., and were presented by Mr. H. D. Jackson, manager of Messrs. Irvin & Johnson at Port Elizabeth, who has also previously donated valuable specimens.

S. brevipinnis is very closely related to the only other species of the genus that has yet been described, *lichia* Bonn., which has been recorded from the western North Atlantic and the Mediterranean, from fairly deep water. Descriptions of that species available to me are exceedingly meagre, the only figure seen being that of Goode and Bean (Ocean. Ichthy., 1895, p. 7, fig. 4,* *Scymnorhinus lichia*). *S. brevipinnis* appears to differ from *lichia* in numerous dimensional relationships, notably in the smaller fins, the caudal lobes being markedly lower. Also Günther (Cat. Fish. B.M., 1861, vol. viii, p. 426), and others, have stated that the teeth of the lower jaw in *lichia* are oblique in juveniles but erect in adults. In my specimens of *brevipinnis*, of which the larger are presumably adults, all but the central symphyseal erect tooth of the lower jaw are oblique, the posterior teeth very markedly so.

In any case, since a number of South African species of fishes, until recently held to be identical with those from the northern hemisphere, have upon detailed comparison of suitable material proved to be distinct, it is felt expedient to maintain *brevipinnis* as distinct from *lichia* until such time as equivalent material from all the recorded areas may be compared.

Jordan and Fowler (Proc. U.S. Nat. Mus., 1903, vol. xxvi, p. 63, *Dalatias lichia*) have given a very brief account of a stuffed specimen of *Scymnorhinus* from Japan, which they have diagnosed as identical with the Atlantic species. This has been accepted by Regan (*loc. cit.*). The few details given by Jordan and Fowler agree neither with my specimens nor with descriptions and the figure of *lichia*. It was stated, for example, that in the Japanese specimen the anterior margin of the mouth is before the anterior border of the eye.

* The text gives fig. 3.

4 *Transactions of the Royal Society of South Africa.*

Although these fishes are bathybial, and so with little to hinder wide distribution, they are obviously very sluggish in habit, and it is not unlikely that a re-examination of the specimen from Japan will establish that it is a distinct species.

Family TRICHONOTIDAE.

No member of this family has previously been recorded from South Africa. Records have hitherto been from the Indo-Australian area.

A new species of the genus *Taeniolabrus* Stndnr. from South Africa is now described.

Taeniolabrus marleyi n. sp.

(Plates I and II.)

Body very elongate, sub-quadrangular in cross-section, somewhat deeper than wide.

Depth 12, length of head (tip snout) 5, or (tip lower jaw) 4·7, in length of body. Eye 6, snout 3·2, postorbital part of head 1·7 in length of head (tip snout).

Head little depressed, snout very sharp, dorsal profile even. Eyes prominent, sub-dorsal in position, projecting above the profile, but vision chiefly lateral. Over the upper margin of the pupil is a small extension from the iris which divides below into radiating stripes, all of a golden colour. Anterior adipose eyelid moderately developed. Interorbital very narrow, with a small longitudinal ridge. Nostrils paired, rounded, minute. Lower margin of preorbital slightly concave above maxilla. Several pores and canals on preorbital and snout. Preorbital depth somewhat less than longitudinal diameter of orbit. Subopercle and interopercle much enlarged, covering branchiostegals.

Gill-opening large, membranes free from isthmus, unite beneath the hind edge of maxilla. Branchiostegals 5. Pseudobranchiae present. Gill-rakers 3+21, very fine and slender, 1·3 in gill-filaments which are 2 in eye.

Vent normal, in front of anal origin.

Mouth large, almost horizontal, slightly protractile. Maxilla partly concealed beneath preorbital, extends to below middle of orbit. The lower jaw projects strongly, forming a prominent mental lobe or chin, the upper jaw almost included. Lower lips finely papillose. Minute curved villiform teeth in a narrow band in each jaw. Upper jaw with a large dentate symphyseal knob, teeth recurved, slightly enlarged. Minute teeth on vomer in an angular patch with anterior median projection. Similar small teeth in a narrow band on palatines. Tongue edentate, apically dilated, free.

Two Interesting New Fishes from South Africa.

5

The intestinal tract is simple, being merely siphonal, the stomach elongate: no pyloric caeca. Liver bilobed, the lobes even, extending almost above vent. The presence of a gall-bladder cannot be established. No air-bladder.

D 47 (or III 44) originates slightly behind the base of the pectoral. Anterior three rays filamentous, spiniform. First two rays detached from remainder, first 2.0, second 1.8 times head. Third ray 1.5 times head. The fourth ray is 2 in head and simple but articulated. The remainder are mostly branched, often very indistinctly so. From the fourth, the rays increase in length slightly to the 10th and are thereafter subequal.

A 39 (or I 38, the fig., Pl. I, shows 37 in error) originates below the 10th dorsal ray, less than a head length behind head, below the tip of the pectoral. 1st ray spiniform, short: remainder bifurcated or branched. Rays gradually increase posteriorly to almost length of dorsal rays.

Pectorals 1.4 in head, inserted fairly low, of 12 branched rays; tip reaches to 14th lateral scale, above origin of anal.

Ventrals I, 5, inserted close together, in advance of pectorals. Spine weak: inner ray simple, remainder branched. 1st ray shortest, remainder increase to 4th, which is filamentous, the total length being 1.4 times the head, the filament is as long again as the fin, which reaches the origin of the anal.

Caudal broadly hastate, of 13 branched rays, slightly longer than head.

Scales cycloid, longer than wide, with angular hind margin, the edges meeting at an angle of about 80° (Pl. II). Lateral line scales with a deep notch in hind edge, and a short vertical groove above the tube (Pl. II).

Lateral line straight, tubules simple. l.l. 57, l.tr. $\frac{4\frac{1}{2}}{5\frac{1}{2}}$, 10 predorsal scales, end above hind margin of preopercle. Head naked except for five scales below the orbit down hind margin of preorbital and 3–4 more behind angle of mouth along anterior margin of preopercle.

Colour (Alive): "Above amber, studded with turquoise blue and red dots. The lower surface faint rosy. Anals and ventrals with numerous dark red dots. Eye with about twenty golden lines, umbrous red above."

(Preserved): Light yellow-brown above with 11 faint darker cross-bars, wider than eye, not reaching to ventral surface, the first over nape extending on to opercle, the last below the last dorsal rays. Series of dusky bordered ocelli along the body, 6 series anteriorly, becoming fewer posteriorly: one ocellus on each lateral line scale. Similar ocelli in about three series along side of head. A few dark dots along lower surface of body. Dorsal faint dusky with 6–8 series of ocelli, anterior two spines with alternate light and dark annular rings. Irregular dark spots, larger posteriorly, over fin. Caudal similar. Anal similar, but lighter, and fewer ocelli. Pectorals light. Ventrals with signs of darker markings. A few dusky mottlings on nape and muzzle. Iris, iridal flap, and radiating lines golden.

Length.—190 mm.

Locality.—Durban (6th June 1935).

Type in the Albany Museum. (H. W. B. M. 969).

This interesting specimen was presented by Mr. H. W. Bell Marley, Principal Fisheries Officer of Natal, after whom it is named. His colour notes of the live fish are given above. Mr. Bell Marley has also sent another specimen which, while almost certainly conspecific, nevertheless differs markedly in the nature and development of the fins. This smaller specimen (155 mm. total length) has D 45, A 37 and l.l. 55. The first three dorsal rays are only slightly longer than the remainder, the third being actually the longest, about 1.7 in head, while the remaining rays are relatively shorter than those of the type, and are almost all simple. Further, the dorsal originates about an eye diameter behind the pectoral base. The caudal is only $\frac{2}{3}$ as long as the head, and broadly rounded. The anal is similar to that of the type, but the rays are shorter, and the origin of the fin is almost a head length behind the head, well behind the pectoral tip. The 4th ventral ray is only slightly extended, the total length being 1.4 in head, and even the filamentous tip does not reach near the vent. There are 3+19 gill-rakers, and the vomerine angular patch has no anterior extension. It is difficult to decide whether these two specimens are conspecific or not. The nature of the dorsal and caudal fins alone might justify distinction, but in general features, shape, markings, etc. there is such marked similarity that specific distinction for the smaller specimen would appear venturesome. Neither specimen shows any trace of sexual development, so that immaturity may be the cause of the numerous variations.

Very few species in this family have been described, and very little is known about them. It would certainly appear that a revision of the genera and species is necessary.

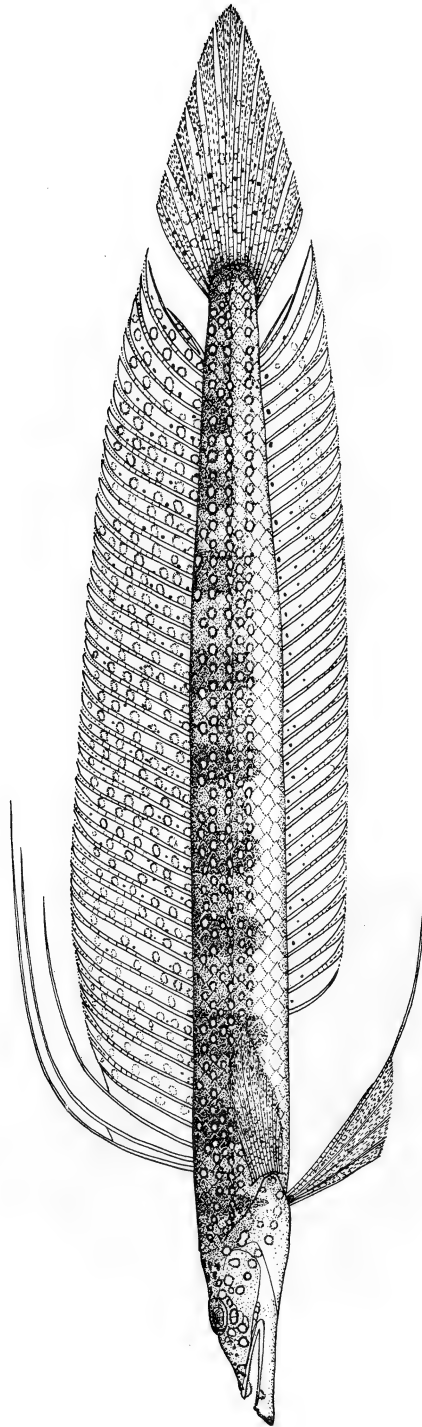
T. marleyi appears to be well differentiated from all others by having the anterior three dorsal rays and the 4th ventral ray elongated, as well as by the scales on the cheek, and by the number of scales in transverse series.

The Ammodytid-like body and head would appear to indicate a mode of existence resembling that of those fishes.

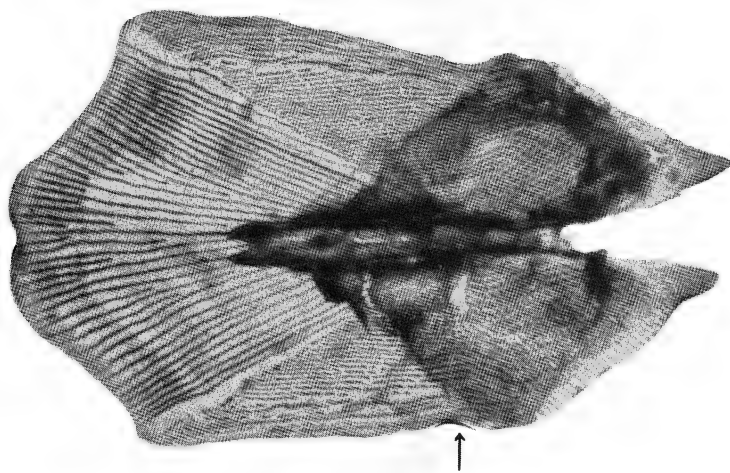
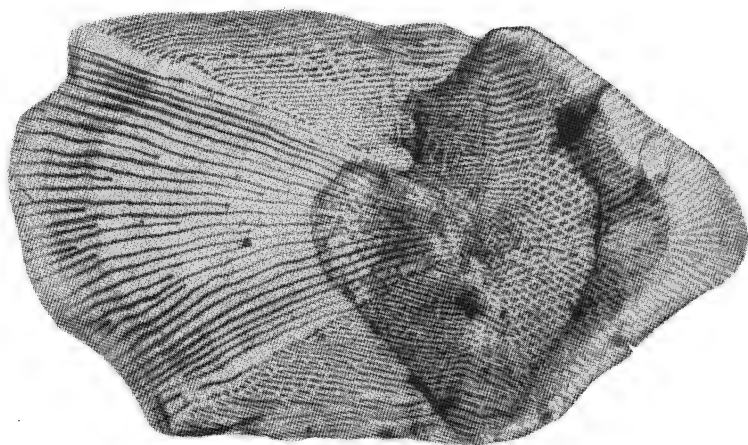
This is a noteworthy addition to the ichthy-fauna list of South Africa.

I wish to express my gratitude to the Research Grant Board of South Africa (Carnegie Fund) for generous financial assistance.

ALBANY MUSEUM,
GRAHAMSTOWN,
August 1935.



Taeniolabrus marleyi n. sp. Nat. size. (Type.)



Scales of *Taeniolebrus marleyi* n. sp.
Left.—24th lateral line scale, $\times 21$. Arrow indicates dorsal groove adjacent to the tubule.
Right.—24th scale above lateral line, $\times 23$.
Both from right side of type.

NEW GOBIOID AND CYPRINID FISHES FROM SOUTH AFRICA.*

By J. L. B. SMITH.

(With Plates III–V and three Text-figures.)

(Read October 16, 1935.)

Family GOBIIDAE.

Gobius vonbondei n. sp.

(Text-fig. 1 and Plates III and V, fig. A.)

Body fairly compressed, markedly so posteriorly. Dorsal profile even, moderately sloping before eyes, snout blunt, rounded.

Depth equal to length of head, 3·5 in length of body. Eye 4·3, inter-orbital 4·0, snout 3·3, and postorbital part of head 2·0 in length of head. Least depth of preorbital 1·8 in eye.

No barbels. Series of papillae on cheeks ; below the eye a row with short vertical transverse series. A series along the lower margin of the preorbital extending beyond angle of mouth on to preopercle. A single series in a shallow groove along the lower surface of each mandible. Nostrils small, posterior circular, anterior with plain flap. A large pore above the anterior nostril.

Mouth moderate, slightly oblique, jaws equal, maxilla extends to below anterior margin of pupil. Teeth in 3–4 rows in each jaw, with an outer enlarged series of 14–15, caniniform. An outwardly flaring curved canine tooth on each side of lower jaw. Palate and tongue edentate. Tongue anteriorly truncated, adnate. A papillose cutaneous process across roof of mouth.

Gill-opening restricted, membranes broadly fused with isthmus from below posterior half of operculum. 5 gill-rakers on lower margin of anterior arch, of curious claw-like design. The upper limbs of the anterior two arches have a forward extension bearing three large claw-like processes, which have below numerous shorter papilliform processes.

D VI + I, 14. First dorsal originates just behind pectoral base, twice as far from caudal base as snout tip. Spines elongate, filamentous, 1st 1·4,

* The Council desires to acknowledge the receipt of a grant from the Carnegie Corporation through the Research Grant Board towards the cost of printing this paper.

2nd 1.2, 3rd 1.0, 4th 0.85, 5th 1.3, and 6th 2.1 in length of head. Base of first dorsal 1.4 in head. Membrane from 6th spine reaches origin of second dorsal. Second dorsal inserted slightly nearer caudal base than snout tip, above the 20th lateral scale, spine 2.2 in head, anterior rays 2.0 in head, increase to the 7th (longest) 1.5 in head, thereafter graduated shorter. Base of second dorsal 1.2 times head. Hind margin of fin does not reach the caudal.

A I, 12. Originates below the origin of the second dorsal. Spine 1.5 times eye; first ray, shortest, 1.7 in head; penultimate, longest, 1.3 in head. When laid back the hind margin of the fin reaches on to the caudal fin. Base of anal equal to that of second dorsal.

Pectoral rounded, of 17 rays, 1.1 in head, tip reaches below origin of second dorsal.

Ventrals united, as long as pectorals.

Caudal broadly rounded, of 15 principal rays. Peduncle about as long as deep.

Scales moderate, mostly ctenoid (Plate III, A), but those on the nape, head, pectoral base, and chest, cycloid. Lat. ser. 52, l.tr. 18, predorsal 23, which end above posterior third of eye. Scales in advance of pectoral base smaller than posterior scales. About ten series of scales across upper portion of opercle, rest of head (except dorsally to interorbital) naked.

Colour.—Brownish, slightly lighter below. Five dark cross-bars, narrower than eye, much narrower than interspaces; first below middle of first dorsal, second below anterior dorsal rays, third below middle dorsal rays, fourth below posterior dorsal rays, last across peduncle. Between each pair a narrower faint stripe. Faint stripes below origin of first dorsal, over nape, and behind eye. Opercle dark below. A faint dark smudge below anterior margin of eye. A large black spot at upper margin of opercle above pectoral base, another similar on upper side of caudal base (ocelli in life?); three small dark spots along base of dorsal; a similar spot on upper part of hind margin of caudal, and four spots along lower margin of caudal. Dorsal, anal, and ventrals dusky, other fins light.

Length.—133 mm.

Locality.—Natal.

Type (♂) in the Albany Museum.

Named after Dr. C. von Bonde, Director of the South African Government Fisheries Survey, who has donated numerous valuable specimens to the Albany Museum.

The type is a ripe male. Conspecific is also a smaller ripe female, 120 mm. total length. A certain amount of sexual dimorphism is exhibited by this species. The body of the female tapers to the peduncle slightly more than that of the male, while there are only the two large spots, one

at the pectoral the other at the caudal base, the smaller spots on the dorsal and caudal being absent. Chiefly the sexes differ in the nature of the dorsal fins. The first dorsal is longer based, but not as high in the female, while in the second dorsal, the posterior rays of that of the female are the longest, the shape of the fin resembling that of the anal. Also the ventral is slightly shorter, scarcely reaching the vent.

D VI + I, 14, A I, 13; lat. ser. 53, l.tr. 19; predorsal 23. 6 gill-rakers.

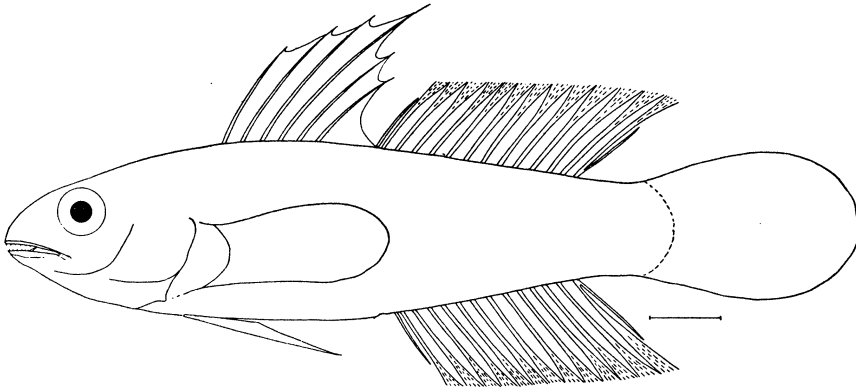


FIG. 1.—*Gobioides vonbondei* n. sp. (Female). The line represents 1 cm.

G. vonbondei is easily distinguished from all other South African species by the high dorsal fin, as well as by numerous other features.

Gobioides gulosus n. sp.

(Text-fig. 2.)

Body fairly slender, sub-cylindrical, compressed posteriorly. Dorsal profile even, with slight concavity before eyes. Snout moderately sharp.

Depth 5.0, length of head 3.1 in length of body. Eye 5.4, snout 3.0, interorbital 6.0, and postorbital 2.1 in length of head. Least depth of preorbital equal to eye.

No barbels. 6–7 undulating series of papillae on cheeks. Various other series; along preopercle margin, double, behind eye to occiput, and along head above upper margins of opercle and preopercle. A series along each lower margin of opercle, with a third forming a triangle. A deep groove containing papillae on each side of snout before eye. Several pores on snout. Chin and lower surface of rami of lower jaw with papillae. Anterior nostril tubular.

Head very depressed, maximum width behind eyes 1.2 in length, considerably wider than deep. Mouth large, oblique, lower jaw projects

slightly. Maxilla extends below anterior border of orbit. Slender conical teeth in 4–5 rows in each jaw, outer series but slightly enlarged. Tongue adnate, truncated. Cutaneous process in roof of mouth narrow. Gill-opening restricted, membranes fused with isthmus from below middle of opercle. 9 gill-rakers on lower limb of anterior arch, fairly short, moderately stout.

D VI+I, 8. First dorsal originates 1·8 times further from caudal base than snout tip, above the 5th lateral scale. Spines slender, 1st 3·0, 2nd 2·2, 3rd (longest) 1·9, 6th 4·0 in length of head. Base of first dorsal 1·9 in head. Two dorsals close together. Second dorsal originates slightly nearer caudal base than snout tip, above the 13th lateral scale. 1st ray 2·0 in head,

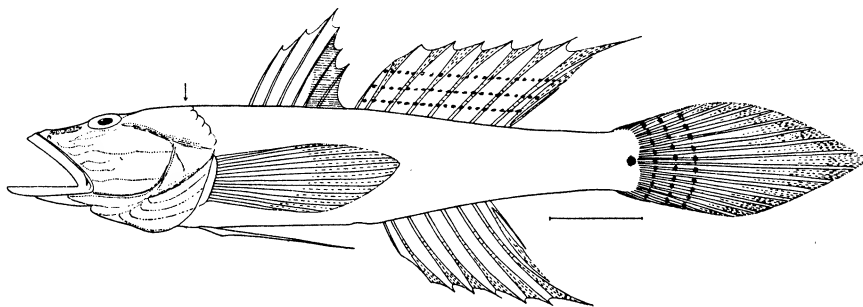


FIG. 2.—*Gobius gulosus* n. sp. The small arrow indicates anterior limit of scaling. The line represents 1 cm.

increase to penultimate (longest) almost as long as head, when laid back reaches well on to the caudal fin. Base of 2nd dorsal 1·4 in length of head.

A I, 7. Inserted below the 2nd dorsal ray, below the 15th lateral scale. Spine short, first ray 2·2, remainder increase to penultimate, longest, 1·2 in head, depressed reaches to caudal base. Base of anal 1·8 in head.

Pectoral more or less lanceolate, of 16 rays, as long as head, tip reaches beyond anal origin, to 16th lateral scale. No free rays.

Ventrals 1·4 in head, reach to vent, basal membrane wide.

Caudal lanceolate, 1·2 times head; peduncle slender, almost 2·5 times as long as deep.

Scales moderate, mostly ctenoid, but cycloid on the nape, on the chest, on ventral surface of body, on pectoral base, and on caudal base. Lat. ser. 31, l.tr. (between dorsal and anal) 8, predorsal 8–9, very small. Posterior scales of body much larger than those anterior to dorsal origin. Head entirely naked except few predorsal scales, which extend almost above hind preopercle margin. Chest only lightly scaled.

Colour.—Uniform dark olive, nape darker, slightly lighter on belly. First dorsal with large dusky blotch over last three spines. Several rows

of dusky spots along base of second dorsal; also over base of caudal. Ventrals dusky. Pectorals light.

Length.—91 mm.

Locality.—Bushman's River, Alicedale (Cape Province, about 30 miles from nearest point of coast).

Type in the Albany Museum.

A single specimen, presented by A. Cruden, Esq.

This species would appear to fall into *Stenogobius* Bleeker, of which somewhat doubtful sub-genus no representative has hitherto been recorded from South Africa.

G. gulosus is well differentiated from all other species from South Africa by various features. It is closest to the widely distributed species *giuris* Ham. Buch., but is distinguished chiefly by the elongated fins, by the absence of scales from the occiput, by the arrangement of the buccal papillae, and by the adnate tongue, besides other features. It is not even unlikely that *gulosus* has originated, by isolation, from *giuris*, or that both species have developed from a common ancestor.

Extensive collecting in the fresh waters of the Eastern Province of South Africa will almost certainly result in the discovery of numerous new species of fishes, some of which at least will not improbably show relationship to, or even traces of origin from, known widely distributed forms. In that area it would appear that geographical and climatic changes have considerably affected the character of the larger rivers. Even those which at one time were presumably of continuous flow, and with few barriers to hinder the inland penetration of marine species, now have the inland freshwater without direct or continuous communication with the sea. Only during floods is there continuous water, but at those times the current is too swift to allow of counter migration. Actually the periodic inundations which occur in that region take heavy toll of the fish life of the fresh waters, for after any heavy spate innumerable dead fresh water fishes are thrown up on the shore in the neighbourhood of the mouth of any large river in the Eastern Province area.

The Bushman's River is tidal for over 20 miles, but beyond that consists at normal times of merely a series of disconnected pools. The course of the river from Alicedale to the sea would be at least 50 miles. Any upward migration in that river would appear impossible, and *gulosus* is most probably a localised fresh water species.

Family ELEOTRIDAE.

Eleotris limosus n. sp.

(Plates IV and V, fig. B.)

Body robust, moderately compressed, maximum width at shoulder 1.2 in depth. Dorsal profile flat, with deep concavity before eyes.

Depth 4.1, length of head 3.3 in length of body, Head 1.2 times wider than deep. Eye 6.5, interorbital 2.4, snout (measured obliquely to tip) 3.4, and postorbital part of head 1.6 in length of head. Least depth of preorbital 1.8 in eye. (Length of head measured obliquely to snout tip.)

Anterior nostril tubular, apically dilated, immediately above maxilla; posterior before the orbit. A large pore close above the anterior nostril. Several papillose, muciferous canals on cheek, two radiating down from the eye; from the anterior nostril along the lower preorbital margin another, which extends beyond the angle of the mouth well on to the preopercle. A groove behind the eye extends to the upper margin of the gill-opening; at the origin next the eye is a large pore; also several others in and above the course of the groove.

Anal papilla broad and flat, about as long as eye.

Gill-opening fairly wide, gill-membranes not united, but fused narrowly below with isthmus. Gill-rakers 12, anterior moderate, stout, posterior mere knobs. Pseudobranchiae well developed. Space between rami of lower jaw wide, transversely rugose. 12-14 apically dilated papillae in a series in a groove along each side of the lower surface of the lower jaw, separated by a small space from a posterior groove containing two similar papillae and ending in a large pore.

Mouth large, oblique, lower jaw projects strongly, maxilla extends to almost below centre of eye. Uniform minute conical villiform teeth in each jaw in a band, anteriorly half as wide as eye: no canines, no enlarged outer series. Palate and tongue edentate. Tongue free, wide, rounded.

D VI + I 8. First dorsal inserted midway between the tip of the snout and the hind margin of the base of the second dorsal, above the 6th lateral scale. Base of first dorsal 2 in head. 1st and 6th dorsal spines shortest, 3rd 2.3, 5th 2.4 in length of head, 1.8 in depth of body. Second dorsal very close to first, separated by a space about 3 in eye. Second dorsal originates above the 17th lateral scale, slightly nearer caudal base than hind margin of eye. First ray (shortest) 2.0, last ray (longest) 1.15 in head, tip of depressed fin reaches well beyond caudal base. Base of second dorsal 1.7 in head.

Anal I, 7. Inserted below the 19th lateral scale, below the base of the second dorsal ray, midway between the caudal base and hind preopercle

edge. Base of anal 2 in head. 1st ray (shortest) 2.5, last (longest) 1.5 in length of head. The depressed last ray reaches the caudal base.

P 14. 1.1 in head, rounded, with heavy base, tip reaches to below the base of the first dorsal ray, to the 19th lateral scale.

Ventrals inserted below pectorals, 1.4 in head, tip reaches just beyond vent, apex of longest ray slightly filamentous.

Caudal 15, large, rounded lanceolate, just longer than the head (base obscured by scales). Peduncle 1.5 times as long as deep.

Scales large, mostly ctenoid (Plate III, B), but the predorsal scales and those on the head, on the pectoral base and on the chest, cycloid. Lateral rows 41 to caudal base, several smaller scales beyond: 1.tr. 13 (dorsal to anal); 12 vertical series on preopercle, 5 on opercle, 18 predorsal. Whole body and head scaly, except muzzle, lower margin of lower jaw and front half of cheek, naked. Caudal scaly basally, other fins not.

Colour.—Uniform dark olive, muzzle slightly darker. Fins dusky; first dorsal with a few basal dark spots, second dorsal and caudal with rows of numerous dark spots. Second dorsal, caudal, anal, and ventral with very narrow light margin (in life faint orange).

Length.—270 mm.

Locality.—Isipingo lagoon, near the sea.

Type in the Albany Museum.

E. limosus is closely related to *ophiocephalus* C. and V. and to *madagascariensis* C. and V., which are indeed only doubtfully distinct one from the other, agreeing closely in all features except that the latter species has a more elongate caudal peduncle and an extra ray in the second dorsal (*fide* Boulenger, F.W.F., Africa, 1916, vol. iv, pp. 15–16). *E. limosus* is differentiated by several features, notably by the greater size of the fins, while the two dorsals are much closer than in *ophiocephalus* and in *madagascariensis*. Further, the teeth of *limosus* are of uniform size, there being no even slightly enlarged outer series. Day (Fishes of India, 1888, p. 312, pl. lxvii, fig. 2) described and figured *ophiocephalus* C. and V., and Boulenger (*loc. cit.*) has accepted his diagnosis, whereas Day's specimens cannot possibly be conspecific with those described by Boulenger. Day stated that his specimens had 31–34 scales, whereas Boulenger gave 35–42. It may be noted that Day's figure agrees in very few significant features with his description, the discrepancies being so marked as almost to appear as if some confusion of specimens had occurred. At all events, either the specimens described by Day were not *ophiocephalus* C. and V., or, if they were that species, then Boulenger's were not. Actually Boulenger's description (*loc. cit.*, p. 15) agrees very well with my specimen, and it is not unlikely that his specimens will be found conspecific with *limosus*.

In view of the habits of the ELEOTRIDAE it would be surprising to find our southern African species identical with those from India.

Family CYPRINIDAE.

Barbus senticeps n. sp.

(Text-fig. 3.)

Body moderately compressed. Depth equal to length of head, 3·4 in length of body. Eye 5·0, snout 3·7, interorbital 3·0, and postorbital 1·8 in length of head.

Snout somewhat blunt and swollen, with sharp concavity, part of a transverse groove, before eyes. Upper surface of snout and head with

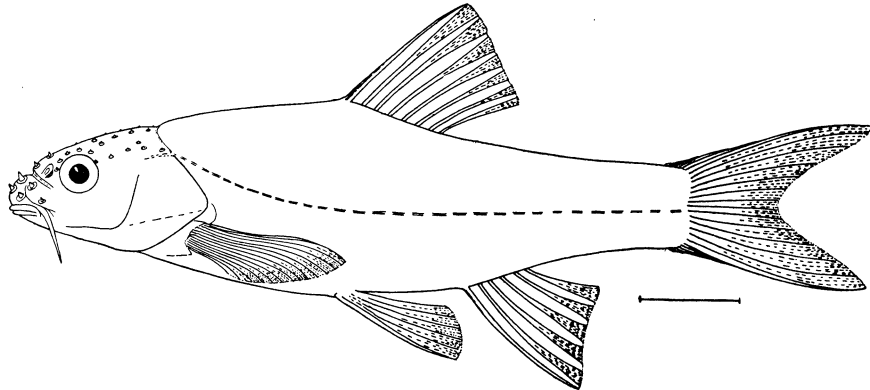


FIG. 3.—*Barbus senticeps* n. sp. (Type). The line represents 1 cm.

numerous spiny tubercles, each with a rounded enlarged horny base; those on the snout large, behind the eyes much smaller. A single barbel on each side, 1·5 times eye.

Mouth inferior, lower jaw included, maxilla extends to below nostrils. 7 gill-rakers on anterior arch.

D III, 7. Inserted slightly nearer snout tip than caudal base. Anterior rays 1·3, posterior 2·5 in head. Edge of fin straight.

A III 5. Inserted twice as far from snout tip as caudal base. Anterior rays 1·3, posterior 2·5 in head. Edge of fin gently concave. Pectorals 1·3 in head, reach to ventral base. Ventrals inserted very slightly in advance of dorsal, 1·4 in head, reach to anal origin. Caudal deeply forked, peduncle 1·8 times as long as deep.

Scales large, with a moderate number of widely radiating striae. l.l. 30, l.tr. 8 (dorsal origin back): 3 between ventrals and lateral line, 10 around peduncle, 14 predorsal.

New Gobioïd and Cyprinid Fishes from South Africa. 55

Colour.—Dark olive-brown above, lighter below. An obscure dark lateral stripe. Tubercles reddish.

Length.—77 mm.

Locality.—Kromme River, Assegai Bosch (near Humansdorp, C. P.).

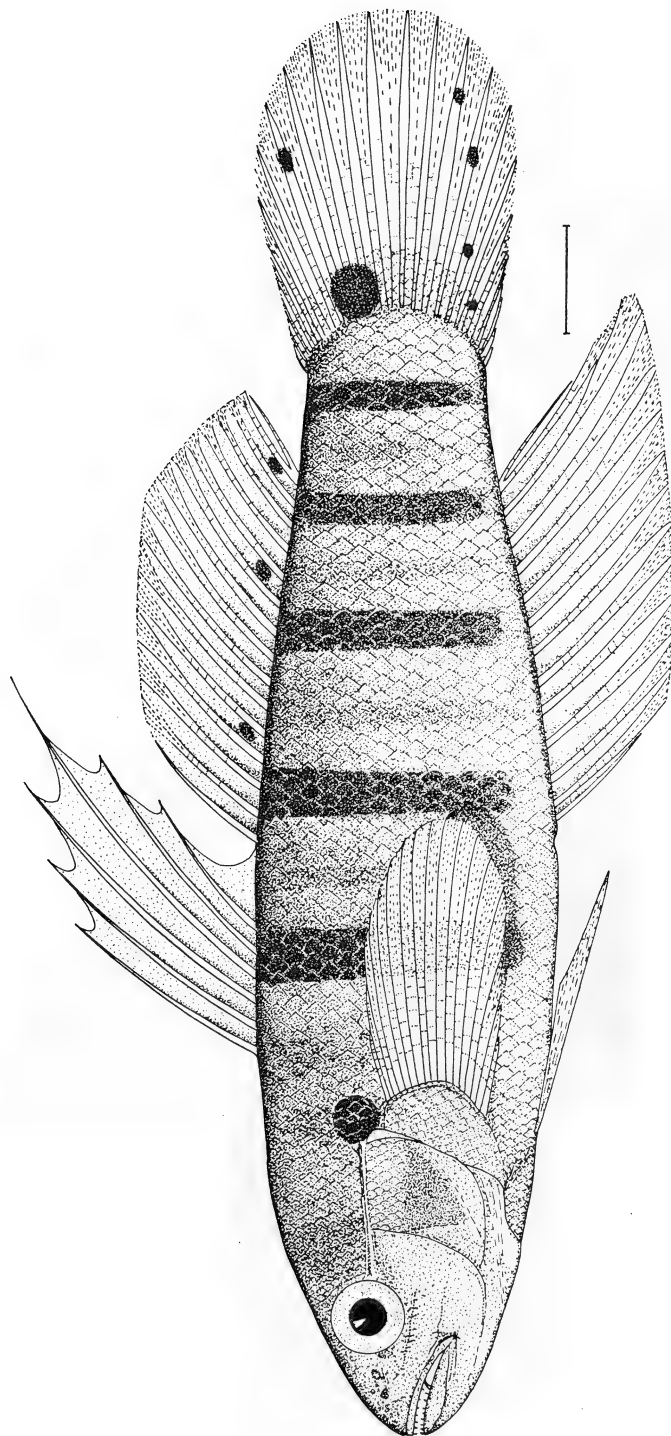
Type in the Albany Museum.

This species falls into the small group which have the dorsal spine simple and flexible, and only one barbel. It is near to *anoplus* Weber and to *afer* Peters, but differs in the much smaller eye, in the much longer barbel, more anterior insertion of the dorsal, fewer scales transversely, and several other features.

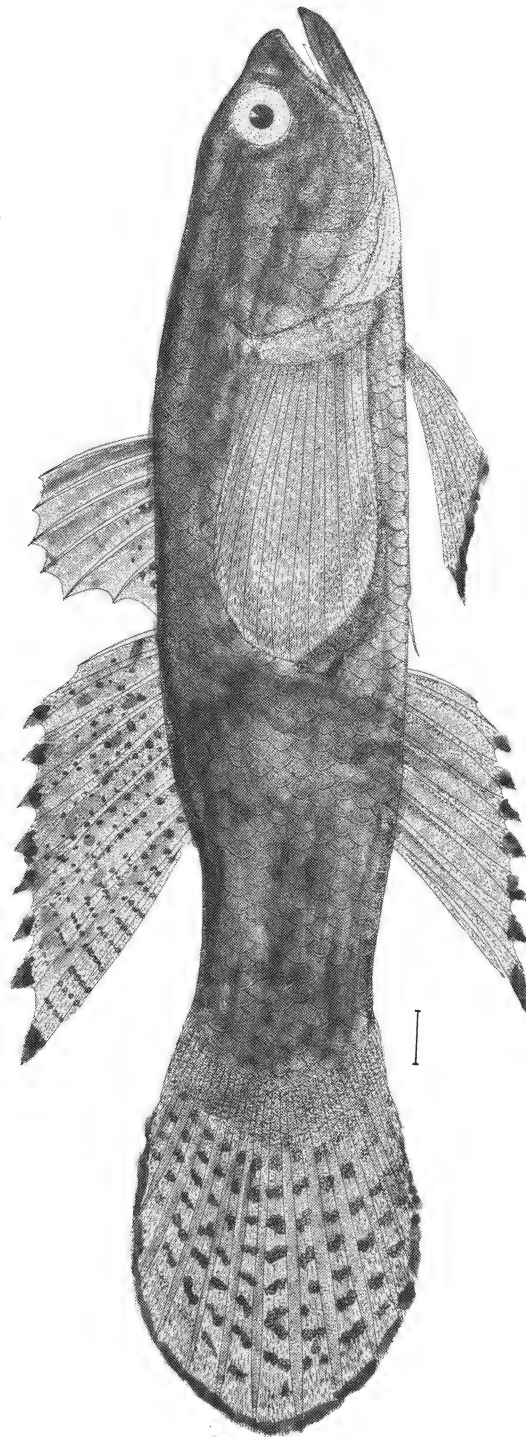
Numerous new species of this genus doubtless await discovery in the Eastern Province, since the fresh water fauna of that region has not been seriously investigated.

I wish to express my gratitude to the Research Grant Board of South Africa (Carnegie Fund) for financial assistance.

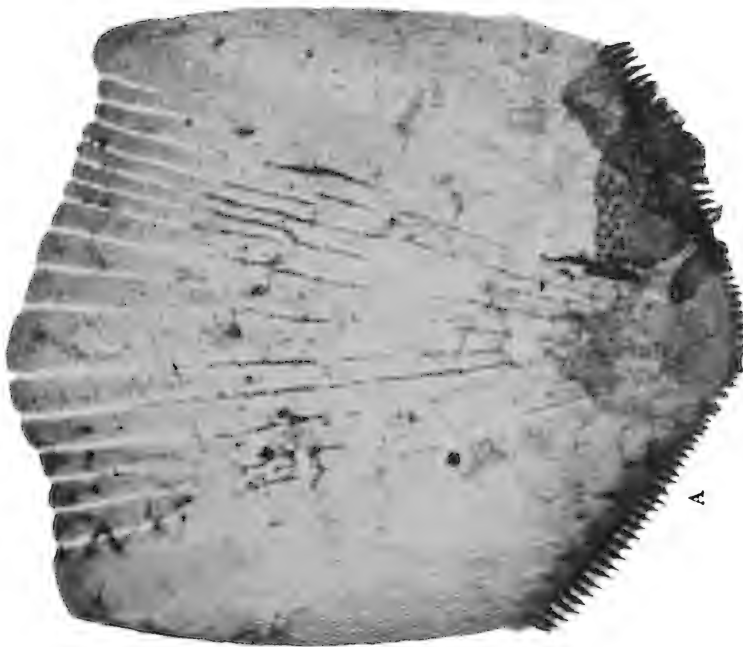
ALBANY MUSEUM,
GRAHAMSTOWN,
September 1935.



Gobius rounboudi n. sp. (Male) Type. The line represents 1 cm.



Elcotris limosus n. sp. (Type). The line represents 1 cm.



A. 12th medio-lateral scale of *Gobius vonbondei* n. sp. $\times 34$. Each from the Type.



B. Similar scale of *Eleotris limosus* n. sp. $\times 12$.

New Records of South African Fishes.

By

J. L. B. Smith, M.Sc., Ph.D., F.R.S.(S.A.),

Albany Museum, Grahamstown.

With Plate XI and 6 Text-figures.

CONTENTS.

	PAGE
<i>Acanthidium quadrispinosum McCulloch</i>	168
<i>Haplochilus katangæ Boulenger</i>	170
<i>Pisoodonophis boro Ham-Buch</i>	171
<i>Mugil crenilabis Forsk</i>	172
<i>Holocentrum sammara Forsk</i>	173
<i>Parapercis pulchella Day</i>	174
<i>Caranx gymnostethoides Bleeker</i>	177
<i>Chætodon trifasciatus Mungo Park</i>	178
<i>Chætodon xanthocephalus Bennett</i>	180
<i>Chætodon kleinii Bloch</i>	182
<i>Pristipomoides argyrogrammicus C. & V.</i>	183
<i>Pomadasys stridens Forsk</i>	185
<i>Pteragogus opercularis Peters</i>	187
<i>Thyrsitoides marleyi Fowler</i>	189
<i>Sarda chilensis C. & V.</i>	191
<i>Blennius fascigula Barnard</i>	193
<i>Petroscirtes tapeinosoma Blkr.</i>	194
Note on the Distribution of Species of <i>Clinus Cuv.</i> in South Africa.	194
<i>Nemacoclinus navalis Barnard</i>	195
<i>Gobius callidus nom. nov.</i>	197

WITHIN the last few years there have been very numerous additions to the ichthyfauna list of South Africa, both of new species, and of known species new to this region. In particular a large number of known Indian and Indo-Pacific forms have

been found to be regular inhabitants of the waters of our eastern coasts. Very many of these fishes have been discovered by Mr. H. W. Bell-Marley, Principal Fisheries Officer of Natal, to whose enthusiasm and zeal South African ichthyology is deeply indebted.

Most of the species described below were obtained by Mr. Bell-Marley.

Family SQUALIDÆ.

Acanthidium quadrispinosum McCulloch. Text-fig. 1.

Acanthidium quadrispinosum McCulloch, Endeav. Fish., vol. iii, pt. 2, p. 100, pl. xiv, fig. 5, 1915.

Head very depressed, especially snout. Snout tip to pectoral origin 4.3 in total length. Body anteriorly little, progressively more compressed posteriorly. Greatest width of head 1.8 in length. Orbit 4.5, snout 2.35, preoral length 1.7, interorbital 3.6, width of mouth 3.6 in length of head (to pectoral origin).

Snout with sharp edges, pentagonal in shape, with angles rounded, tapers sharply before nostrils. Nostril width 2.3 in internarial distance. Orbit equal to distance from nostrils. Centre of eye very slightly nearer pectoral origin than snout tip. Orbit slightly less than distance to anterior gill-slit. Spiracles 2 in orbit, 1.5 times distance behind orbit. Gill-openings graduated wider posteriorly, last more than half orbit deep.

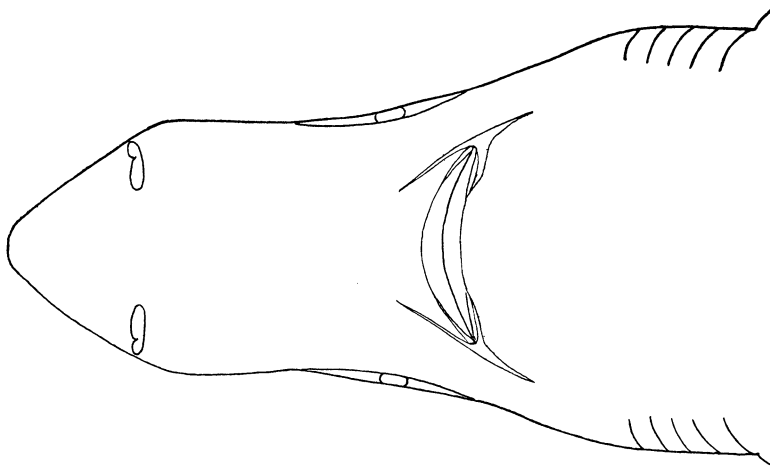
Mouth gently curved. Upper teeth with broad bases, the single cusp broad at base, more or less erect, 26 in anterior series. 30 anterior teeth in lower jaw, bases broad, cutting edges almost horizontal. Lips very thin, not continuous across mouth. Labial grooves very oblique, slightly longer anteriorly, total length almost width of mouth.

First dorsal inserted slightly nearer snout tip than hind margin of second dorsal base. Spine 1.2 in orbit, distal third exposed. Greatest height of soft fin only slightly more than spine; base of first dorsal (with spine) 2.4 times orbit. Base of first dorsal (with spine) half the interdorsal space. Edge of fin gently convex, posterior rays elongated. Origin of second

NEW RECORDS OF SOUTH AFRICAN FISHES. 169

dorsal behind hind margin of ventral base, slightly nearer hind margin of caudal than origin of first dorsal. Spine 1.3 times orbit. Soft fin anteriorly elevated; greatest height 1.5 times orbit; last portion elongated, reaches beyond the origin of the

TEXT-FIG. 1.



Lower surface of head of *Acanthidium quadrispinosum* McCull.
 $\times \frac{3}{7}$.

lower caudal lobe; edge of fin emarginate. Base of fin (with spine) slightly less than base of first dorsal. Both dorsal spines with two grooves on each side.

Pectorals with gently rounded outer margins; inner extremity does not reach below first dorsal origin. Ventrals inserted slightly more than twice as far from pectoral origin as from origin of lower caudal lobe. Apex reaches to below the anterior fourth of the second dorsal. Caudal moderately deep; greatest transaxial width through lower lobe slightly greater than height of second dorsal. A slight notch between extremities of upper and lower lobes.

Whole body and fins covered with minute scales; on the anterior part of the snout they are granular; on most of the rest

of the body they bear spines, pedunculated, mostly tridentate. On the upper caudal surface the spines are broadly hastate, occasionally with small basal cusps.

COLOUR.—Grey-black, slightly lighter below.

LENGTH.—700 mm.

LOCALITY.—Off Algoa Bay in 150 fathoms.

The single specimen described was presented by J. H. Jackson, Esq., Manager of Messrs. Irvin & Johnson, Port Elizabeth.

This specimen is unquestionably conspecific with the Australian species *quadriscopinosum* McCull., which has not previously been recorded from South Africa.

A. natalense Gilch. is of doubtful validity. The original description (Gilchrist, 'Fish. Mar. Surv. Spec. Rep. III', p. 49, pl. vii, fig. 2) is most inadequate, and I have not been able to examine the type. *A. natalense* is supposed to differ from *quadriscopinosum* in that the former has the eye slightly nearer pectoral base than snout tip. In McCulloch's figure (loc. cit.) of the latter species the centre of the eye is actually in that position, and Gilchrist's figure shows so little difference in that particular character that *natalense* is at best a doubtful species.

Family CYPRINODONTIDÆ.

Haplochilus katangæ Boulenger.

Haplochilus katangæ, Blgr.; Boulenger, F. W. Fishes Africa, vol. iii, p. 67, fig. 54, 1915.

Body fairly compressed, depth 3.9, length of head 3.4 in length of body. Eye 3.6, snout 3.3, interorbital 2.2, and post-orbital length 2.3 in length of head. Mouth terminal, sub-vertical, lower jaw projects. Head depressed, interorbital but faintly convex. Preorbital depth 4 in eye.

D. 10 inserted above the 5th anal ray, 1.8 times further from snout tip than caudal base. Penultimate ray longest, about twice eye.

A. 14, inserted 1.6 times further from snout tip than caudal base. 8th or 9th ray longest, about twice eye.

NEW RECORDS OF SOUTH AFRICAN FISHES. 171

Pectorals 1·3, ventrals 1·8 in head. Ventrals inserted 1·4 times further from caudal base than snout tip; do not reach anal origin. Caudal rounded, 1·3 in head, peduncle twice as long as deep.

Scales cycloid, 26–27 lateral series, 1. tr. 6 (ventral base up). 15 predorsal to hind margin of head. No lateral line pits.

COLOUR.—Olive-brown above, lighter on belly. Each scale, light centre with darker edge. Dark band from caudal base slightly below middle of side to pectoral base, continued faintly over operculum and through eye to snout. All fins except ventrals dusky. Caudal and anal with faint rows of darker spots.

LENGTH.—33 mm.

LOCALITY.—Kula River, Zululand.

A single specimen. (H. W. Bell-Marley. 3.ix.1935.) Previously reported from the Belgian Congo.

There does not appear to be very much difference between *katangæ* and *myaposæ* *Blgr.*

Family OPHICHTHYIDÆ.

Pisoodonophis boro *Ham-Buch.*

Pisoodonophis boro (*Ham-Buch*), Weber and de Beaufort
Fishes Indo-Austr. Archip., vol. iii, p. 297, figs. 138, 140, 141, 1916.

Head 3·7 in body to vent. Tip of snout to vent 1·8 in caudal. Eye about 3 in snout, almost 2 in interorbital, slightly nearer hind margin of mouth than snout tip. Mouth cleft about 4 in head, extends an eye diameter behind eye. Lower jaw shorter. Teeth obtuse, sub-conical, in several series in jaws and on palate. Gill-openings small, embrace pectoral base.

Dorsal originates about a pectoral length behind tip of pectoral.

COLOUR.—Light brown above, lighter below.

LENGTH.—470 mm.

LOCALITY.—Zululand coast.

A single specimen. (H. W. Bell-Marley, vii.1935.)

An Indian species, only once (Fowler, 1929) previously recorded from South Africa.

Family MUGILIDÆ.

Mugil crenilabis Forsk.

Smith, Ann. S. Afr. Mus., vol. xxx, pt. 5, p. 609, fig. 6, 1935 (Revision of South African Mugilidæ).

This species is exceedingly uncommon in our area, and despite a search of several years, no adult specimen has been obtained until recently. The description of *crenilabis* in the above revision was based on juvenile specimens. The large specimen now to hand, obtained by Mr. H. J. Koch at Isipingo, requires that the diagnosis of that species should be emended.

Depth 4, length of head 4.6 in body length. Eye 4.6. interorbital 1.9, snout 4.0, and postorbital length 1.6 in head. Adipose eyelids rudimentary. Lower margin of preorbital bent and sharply emarginate. Upper lip at snout tip deeper than half eye, lower margin with 5-6 transverse series of fleshy tubercles. Lower lip with expanded rugose fringe. Maxilla entirely concealed.

D. IV + 1, 8, first dorsal inserted midway between snout tip and caudal base. 1st spine 1.9 in head, spines rather feeble. Origin of first to origin of second dorsal 1.1 times head. First dorsal originates over the 12th, the second over the 24th scale. Pointed sheath scale extends behind origin of dorsal 2.6 in head, and 5.5-6 in distance from origin of first dorsal to snout tip. Second dorsal sub-falcate anteriorly, densely scaly.

A. III, 9, inserted below the 23rd lateral scale. In shape similar to dorsal, densely scaly.

Pectorals longer than 1.1 times head, with fairly strong axillary scale, 3.5 in length of fin. Fin densely scaly. Ventrals 1.5 in head, margins truncate. Caudal emarginate.

Scales all cycloid, dorsal scales with moderate scalloping along exposed edges, grooves long and narrow. Lat. ser. 41, l. tr. 13, 3 cheek scales, 13 predorsal to above hind margin of head.

COLOUR.—Silvery olive, axil of pectoral and margin of upper ray black, pectoral dusky behind.

LENGTH.—250 mm.

NEW RECORDS OF SOUTH AFRICAN FISHES 173

LOCALITY.—Durban.

The main growth changes in *crenilabis* appear to be an increase in length of the pectorals (from 1·3 in to 1·1 times head), of the pointed scale at the dorsal base, and of the ventrals, while the two dorsals become more widely separated. Also the interorbital is wider, the postorbital is shorter, and a scaly process develops in the pectoral axil.

Family HOLOCENTRIDÆ.

Holocentrum sammara Forsk. Pl. XI.

Holocentrum sammara (Forsk), Barnard, Ann. S. Afr. Mus., vol. xxi, p. 365, 1927.

Depth 3·2–3·4, length of head 2·8 in length of body. Eye 2·7, snout 4·2, interorbital 4·1, and postorbital 2·6 in length of head.

Preorbital serrate below; anteriorly an enlarged curved denticle. Preopercular spine short, not extending beyond subopercular margin. Two short divergent opercular spines, upper longer, apex beyond opercular margin. All free margins of opercular bones serrate. Exposed surface of post-temporal striate. Interorbital flat, with a longitudinal furrow, porous. Occiput with radiating longitudinal ridges. Posterior nostril without denticles. Mandibular rami canalized and porous below. Mouth fairly large, horizontal, lower jaw projects strongly. Villiform teeth in bands in jaws, and on vomer and palatine. Maxilla extends to almost below centre of eye. Premaxillary pedicels reach to or near frontals. 8–9 gill-rakers on lower limb of anterior arch, slender, 2 in gill-filaments.

D. XI, 12, inserted behind opercular margin. 1st spine 2·6, 2nd 2·2, 3rd and 4th 2·0 in head, thereafter graduated shorter to penultimate, with last spine somewhat longer. Soft rays anteriorly elevated, 2·4 in head. Base of spinous dorsal 1·1 times, of soft dorsal 3·0 in head.

A. IV, 8, inserted below middle of soft dorsal, 3rd spine 1·4 in head, very strong. Pectorals 1·8, ventrals 1·6 in head. Caudal deeply forked, lobes rounded, peduncle slender.

Scales strongly denticulate, not, or scarcely striate. l. l. 42, l. tr. $\frac{3}{7-8}$. 7 predorsal, end above hind margin of eye. 4-5 cheek scales, head otherwise naked.

COLOUR.—(Preserved specimen): Silvery red-brown grading lighter below. A dusky subdorsal band from nape to end of dorsal; a moderate dusky band embracing the course of the lateral line. Faint narrow lines along the scale rows. Top of head dusky, silvery red below. Pectorals and ventrals light. Spinous dorsal faint dusky with a large dark blotch between 1st and 4th spines. First dorsal ray, 4th anal spine, 1st anal ray and outer margins of caudal lobes dusky, fins otherwise faint rosy.

LENGTH.—45-107 mm.

LOCALITY.—Durban: Delagoa Bay.

According to Barnard (loc. cit.) the inclusion of this species in our ichthyfaunal list is based on a specimen presented by Sir A. Smith to the British Museum. The re-discovery of this species in our area after so long an interval is of interest.

Family PINGUIPEDIDÆ.

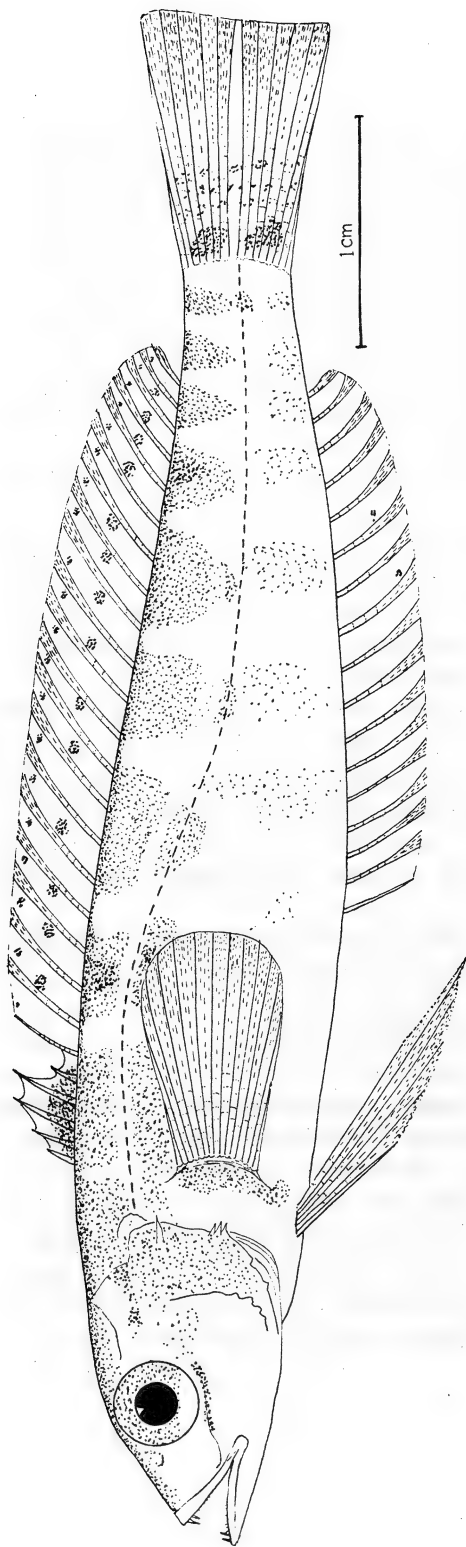
Parapercis pulchella Day. Text-fig. 2.

Parapercis pulchella Day; Fishes of India, p. 262, pl. lxxviii, fig. 2, 1878-88.

Body robust, cylindrical. Snout conical. Depth 5.0, length of head 4 in body-length. Eye equal to snout, 3.6, post-orbital part of head 2.1 in length of head. Interorbital very narrow, about 3.5, preorbital depth 2 in eye.

Mouth moderate, lips moderately thick, lower jaw projects slightly, maxilla extends below anterior third of eye. Villiform teeth in a band in each jaw, outer row enlarged, caniniform, mid outer tooth largest. Fine teeth on vomer, palatines edentate. Six short gill-rakers on lower limb of anterior arch. Upper opercular spine extends beyond membrane margin, lower a group of 3 smaller spines. Preopercle margin undulate, more or less spinate round angle.

TEXT-FIG. 2.



Parapercis pulchella Day.

D. V, 21, inserted behind posterior opercular margin. 1st spine 10, 2nd 6, 3rd and 4th subequal 4.2 in head, 5th abruptly shorter. 1st ray shortest 4.0, 2nd 3.4 in head, thereafter increase to mid-posterior, last rays slightly shorter. Base of spinous fin 3 in, of soft fin twice, head length.

A. I, 16, inserted below the 5th dorsal ray, rays slightly shorter than dorsal rays.

Pectorals rounded, 1.4 in head, reach to below the 5th dorsal ray. Ventrals as long as head; 4th ray (inner) longest, reaches to anal origin. Caudal sub-truncate.

Scales ctenoid, those on middle of side near lateral line with 10–12 radiating striæ. l. l. 60, l. tr. $\frac{5}{16}$ (below spinous dorsal).

11 or 12 predorsal, 5–6 series on cheek. Lateral line undulate, curves up over pectoral. Scaling on nape ends above preopercle margin. Muzzle naked. Caudal and pectoral with scales over base, other fins naked.

COLOUR.—(Preserved): Grey tinged faint reddish. 8–9 faint dusky cross-bars, fade out over lateral-line, reappear below. Two dusky to red areas on caudal base, another on pectoral base continued ventrally. Soft dorsal with a row of small black spots near apices of rays, also a row of larger dark spots along middle of rays. Fins light-dusky. Lower margin of iris light.

(Fresh): The body variously speckled and marked with red or red-brown. The cross-bars not prominent.

LENGTH.—65 mm.

LOCALITY.—Durban, rock-pool.

A single specimen (H. W. Bell-Marley, 980).

This obviously juvenile specimen is almost certainly conspecific with the Indian pulchella. There are minor variations; e. g. the dorsal is inserted further back than is shown in Day's figure (loc. cit.), but his figures frequently suffer from what may be a form of artistic distortion. Further, the markings are not quite identical, there being a longitudinal stripe along the soft dorsal in Day's figure, whereas in my specimen there is a row of large dots. Also my specimen has

one fewer anal ray than the Indian form. These variations do not justify specific distinction for the South African specimen. *P. pulchella* has not previously been recorded from South Africa.

P. robinsoni Fowler ('Ann. Natal Mus.', vol. vi, pt. 2, p. 261, fig. 5, 1929) may prove to be the adult of *pulchella*, but Fowler stated 31 (9/22) transverse series of scales for *robinsoni*; if that is correct then *robinsoni* is probably distinct.

Family CARANGIDÆ.

Caranx gymnostethoides Bleeker.

Caranx gymnostethoides Bleeker; Day, Fishes of India, p. 217, pl. xlviii, fig. 6, 1878-88.

Body robust, moderately compressed, elongate. Dorsal profile steep from above eye, slightly concave before eyes, with sharp convexity above snout end. Nape with various series of arborescent canals.

Depth equal to length of head, 3.3 in length of body. Eye 5.0, snout 2.5, interorbital 3.0, and postorbital 2.3 in length of head.

Maxilla extends below anterior margin of eye. Small villiform teeth in bands in each jaw, no outer enlarged series; also minute teeth on vomer and palatines, and in a longitudinal median patch on tongue. Nostrils close together, twice as far from snout tip as anterior eye margin. 18-19 gill-rakers on lower limb of anterior arch, slightly longer than gill-filaments, 1.6 in eye.

D. VIII + I, 29, inserted an eye diameter behind pectoral base. longest spine 2.5 in head. Anterior rays falcate, 1.6 in head; last ray enlarged, twice as long as penultimate.

A. II + I, 24, anterior rays falcate, 1.6 in head, last ray enlarged. Anal inserted at level of hind margin of base of elevated soft dorsal.

Pectorals falcate, 1.35 times head; tip reaches well beyond elevated part of anal. Ventrals 2.1 in head, do not reach vent. Caudal damaged, peduncle depressed.

Scales moderate, Breast, from behind ventral base obliquely up halfway to pectoral base, naked. Top of head, interorbital and muzzle naked. 19 spinous scutes, extend forward to below the ante-penultimate dorsal ray. Lateral line makes a long curve up over the pectoral, straightens out below middle of soft dorsal.

COLOUR.—Olive above, silvery below. An indistinct small curved dark area near upper opercular angle. Dorsal, anal, ventrals, and apex of pectoral, brownish. Fins otherwise light.

LENGTH.—390 mm.

LOCALITY.—Algoa Bay.

A single specimen presented by the Port Elizabeth Museum.

No specimen of *gymnostethoides* from South Africa has hitherto been described. Fowler ('Proc. Ac. Nat. Sci. Phil.', vol. lxxxvii, p. 381, 1935) has recorded a juvenile of that species from Natal, without description, and with brief notes which do not clearly indicate whether the identification was positive or not. In genera such as *Caranx Lacep.*, in which the differentiation of juveniles is not easy, a full description of any specimen upon which a new record is based is desirable.

The present specimen is almost certainly conspecific with *gymnostethoides Bleeker*; Day's figure (loc. cit.) shows the anal fin to originate considerably further forward than in my specimen, and the whole of the area below the pectoral base naked. Also the scutes are shown larger, and to extend further forward than in my specimen, while the anterior dorsal and anal lobes are neither falcate, nor as elevated as in my specimen.

The occurrence of *gymnostethoides* as far south as Algoa Bay is noteworthy.

Family CHÆTODONTIDÆ.

Chætodon trifasciatus Mungo Park.

Chætodon trifasciatus Mungo Park; Fowler, U.S. Nat. Mus., Bull. 100, vol. viii, p. 65, 1929 (references and synonymy).

Body ovate, dorsal profile only moderately steep, slightly undulate before eye. Snout moderately blunt, lower jaw projects slightly.

NEW RECORDS OF SOUTH AFRICAN FISHES. 179

Depth 1.6–1.7, length of head 3.3 in length of body. Eye 3.4–3.5, snout 4.2, interorbital 3.5, and postorbital 2.6–2.8 in length of head. Maxilla extends to below anterior nostril. Gill-rakers small, alternately very short, 15 on lower limb of anterior arch.

D. XIII, 22–23, inserted behind pectoral base. Spines increase to the 5th, thereafter subequal. Base of spinous fin about twice that of soft. Soft fin rounded.

A. III, 19, soft fin rounded. Pectoral 1.1, ventral 1.2 in head; latter fin reaches vent. Caudal sub-truncate.

Scales of equal size, rows slightly obliquely up and back. 1. l. 31, ends below soft dorsal origin. Lateral series 38, l. tr. $\frac{6}{15}$, from dorsal origin.

COLOUR.—Light grey-yellow. 3 curved dark cross-bars on head, anterior over muzzle, next, widest, from nape through eye to isthmus joining fellow, less than eye; hindmost, narrowest, from below dorsal origin over postocular down to interopercle. A narrow light-blue line along each scale row on side. Soft dorsal with a narrow dark sub-marginal line; another lower. From peduncle upwards to soft dorsal a lanceolate dark patch, bordered yellow. Soft anal with a narrow dark marginal line, fin deep orange to a sub-basal heavy dark band, bordered yellow. Peduncle orange, to a dark bar across middle of caudal rays. Pectorals and ventrals light yellow.

LENGTH.—35–80 mm.

LOCALITY.—East London: Delagoa Bay.

A characteristic species, with contrasted vivid colour pattern, now recorded for the first time from South Africa.

In recent years the normal flow of the Mozambique current along the shore at East London is periodically interrupted and replaced by much colder water. When the warmer water is inshore, numerous tropical species are found in the rock-pools, but are not observed when the colder water remains. Usually these tropical species are most abundant inshore just before the appearance of the colder water.

Chætodon xanthocephalus *Bennett*. Text-fig. 3.

Fowler, U.S. Nat. Mus. Bull. 100, vol. viii, p. 82, 1929 (references and synonymy); and *Chætodon nigripinnatus* *Desjardins*, loc. cit. p. 83.

Body elevated ovate. Dorsal profile steep, deeply concave above eye to snout. Snout sharp, sub-conical.

Depth 1·6, length of head 3·0 in length of body. Eye 3·8, snout 3·0, interorbital 3·2, and postorbital 2·4 in length of head. Maxilla extends between tip of snout and anterior nostril. Gill-rakers small, 10–11 on lower limb of anterior arch. Preopercle margin feebly serrate.

D. XIV, 25, inserted above hind edge of opercle. Spines increase to the 6th, and thereafter remain subequal. Base of spinous fin about 1·6 times that of soft. Edge of soft fin broadly rounded.

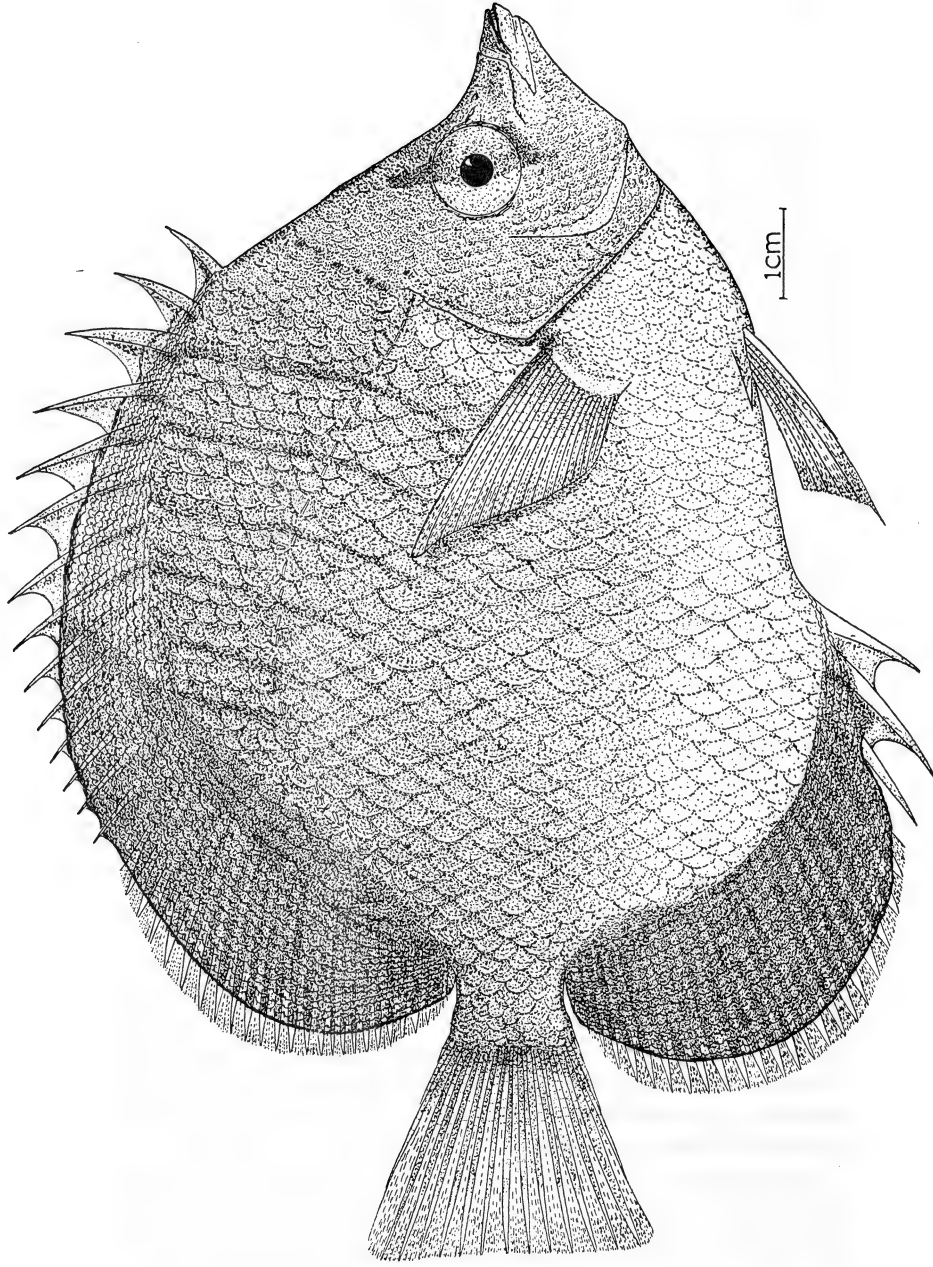
A. III. 24, edge of soft fin broadly rounded.

Pectoral 1·4, ventral 1·3 in length of head, latter fin reaches vent. Caudal truncate.

Scales above lateral line graduated upwards smaller than those below. Rows below lateral line more or less horizontal, slightly inclined upwards. Rows above lateral line run with dorsal profile. 1. l. 36, 1. tr. 11/19, from dorsal origin. 45 predorsal, 7–8 across cheek. Soft dorsal and anal scaly to submarginal band.

COLOUR.—(Preserved): Yellow-brown, nape dusky. Very narrow faint ocular cross-bar, visible just above and below eye. 5–6 faint lines across upper part of body. Soft dorsal and anal dark to near margins, with faint darker marginal line, outer margin of fin light or yellow. Membrane of spinous dorsal basally dark, with posterior 6–7 spines in dusky extension from soft fin. Ventrals, caudal and pectorals light. (Living): “Six curved violet lines across body. Below eye, back of pectoral to vent yellow. Dorsal, and ventrals rich chrome yellow with paler borders. Spinous dorsal orange red above, also caudal base. Margins of caudal yellow, centre violet.” (H. W. Bell-Marley.)

TEXT-FIG 3.



Chatodon xanthocephalus Bennett.

LENGTH.—140 mm.

LOCALITY.—Durban (H. W. Bell-Marley, 966).

A rare species which has not been taken for very many years in South African waters.

The brilliant coloration of the living fish fades on preservation so that unless the changes are followed, it might easily be supposed that the fresh and the preserved forms represent distinct species. Probably on that account the species has several synonyms; *nigripinnatus Desjardins* is certainly synonymous.

Chætodon kleinii Bloch.

Chætodon kleinii Bloch; Barnard, Ann. S. Afr. Mus., vol. xxi, p. 614 (Mozambique), 1927; Fowler, U.S. Nat. Mus., Bull. 100, vol. viii, p. 113, 1929; Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxxvi, p. 480, fig. 45 (*cingulatus* Fwlr.), 1934; Fowler, *ibid.*, vol. lxxxvii, p. 396 (*cingulatus*), 1935.

This species is exceedingly uncommon in our area. Recently two specimens have been obtained from Durban, the larger of which was obviously identical with that described by Fowler as *cingulatus*. It proved also identical with the Mozambique specimen described by Barnard as *kleinii*. The latter specimen was therefore sent to the British Museum, and Mr. Norman has confirmed (in litt.) its identity with *kleinii*.

The sole difference between *cingulatus* and *kleinii* is that the former has not two diffuse broad bands across the body from the dorsal. Later (1935) Fowler has identified as *cingulatus* a specimen from Durban which shows signs of these sub-dorsal markings; thus indirectly the identity of *cingulatus* with *kleinii* has been recognized.

The smaller specimen from Durban is just emerging from the *Tholichthys* stage. The ocular band is only faintly marked, and is somewhat broader than in the adult. The body is otherwise of uniform colour.

Family LUTIANIDÆ.

Pristipomoides argyrogrammicus C. & V. Text-fig. 4.

Pristipomoides argyrogrammicus (C. & V.); Fowler, U.S. Nat. Mus., Bull. 100, vol. xi, p. 189, 1931.

Body elongate-ovate, moderately compressed. Depth equal to head, 3.6 in length of body. Eye 4.3, snout 3.1, interorbital 3.4, and postorbital part of head 2.2 in length of head. Preorbital depth 1.6 in eye. An obscure transverse depression on head behind eyes. Posterior nostril circular, small. Preopercle margin indistinctly serrate. Exposed blade of post-temporal striate.

Mouth moderate, maxilla exposed, extends below anterior fourth of eye. An outer enlarged somewhat irregular series of conical or caniniform teeth in each jaw; behind these an inner band of villiform teeth. Fine teeth in bands on vomer and palatines, incurved on latter. 14 gill-rakers on lower limb of anterior arch.

D. X, 11. first spine very slender, less than eye, 4th and 5th subequal, longest 2.6 in head, remainder shorten to 10th, 3 in head. Anterior soft rays as high as last spine, shorten posteriorly, last ray much enlarged, 1.9 in head, reaches almost to caudal base. No notch in dorsal fin.

A. III. 8, soft fin similar shape to dorsal, last (long) ray 2 in head. Dorsal and anal naked.

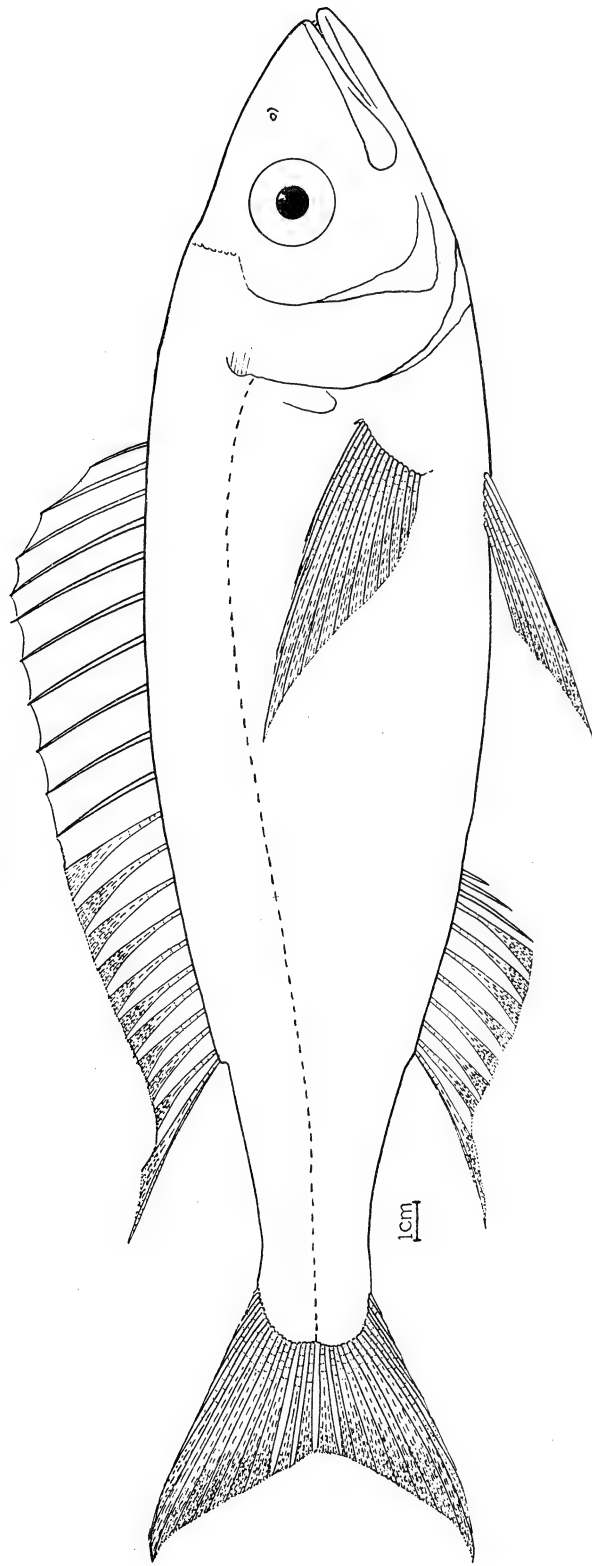
Pectorals 1.1 in head. Ventrals 1.3 in head, do not reach vent. Caudal lunate, scaly to near margin.

Scales feebly ctenoid. 1. l. 61, 1. tr. $\frac{7}{15-16}$. 6 cheek scales,

16 predorsal, end behind eye. 8 across opercle. Preopercle flange naked. Interorbital, snout, muzzle (and preorbital) naked.

COLOUR.—(Preserved): Reddish. Operculum, snout and top of head darker. Scales, especially dorsal, with dusky margins. (Fresh): "Rosy, shot pale violet. Gamboge edges to scales give appearance of lines. Pectoral yellow. Outer rays of ventrals pale blue. Anal rosy with red patch anteriorly. Caudal red, gamboge tips." (H. W. Bell-Marley.)

TEXT-FIG. 4.



Pristipomoides argyrogrammicus (C. & V.).

NEW RECORDS OF SOUTH AFRICAN FISHES. 185

LENGTH.—415 mm.

LOCALITY.—East London.

A single specimen (H. W. Bell-Marley, No. 946).

I have seen the South African Museum specimen from Natal, described by Barnard ('Ann. S. Afr. Mus.', vol. xxi, p. 648, 1927) as filamentosus *C. & V.* That author stated palatine teeth to be absent, but they are present in the specimen, and being incurved are not easy to detect. The South African Museum specimen and mine are unquestionably conspecific. The gill-raker count given is that of the former, the gills having been removed from mine.

Fowler's treatment of the Indo-Pacific species of *Pristipomoides* *Blkr.* (loc. cit., pp. 186–193) is not very satisfactory; e. g. he uses the number of gill-rakers as his primary key-character, and gives 12–13 for microdon *Steindachner*, and 15–16 for argyrogrammicus. Then, in a footnote to the description of the former species he states that microdon from Okinwa has 15, from Hawaii 16–17 gill-rakers.

The South African species agree best with the diagnosis of argyrogrammicus *C. & V.*, which is the oldest species. In Fowler's descriptions, so little difference of any significance is shown between the four nominal species that it would not be surprising to find the eventual recognition of only one somewhat polymorphous form.

Family PLECTORHYNCHIDÆ.

Pomadasys stridens (*Forsk.*).

Pomadasys stridens (*Forsk.*); Fowler, U.S. Nat. Mus., Bull. 100, vol. xi, p. 319, 1931 (references and synonymy).

Body robust, slightly compressed, not very deep. Head rather broad, mouth small. Profile of snout low. Depth 3·1, length of head 3·0 in length of body. Eye 3·7, snout 3·1, inter-orbital 3·3, postorbital 2·1 in head length. Preopercle with straight hind edge, finely serrate. Maxilla extends to below posterior nostril. 9–10 stout gill-rakers on lower limb of anterior

arch, 3.5 in gill-filaments, which are 1.7 in eye. A defined pit and two anterior pores on chin.

D. XII. 14, inserted above just behind opercular margin. Spines moderate, 1st 7.5, 2nd 3.8, 3rd 2.8, 4th and 5th longest 2.2 in head; remainder decrease to the penultimate, and 12th spine slightly longer. Anterior rays longest subequal 3 in head. Edge of soft fin gently convex. Base of spinous fin 1.1, of soft fin 1.6 in head.

A. III 7, inserted below the 4th dorsal ray; 2nd spine 2.5 in head, longer and stronger than 3rd. Soft rays 2.2 in head, edge of fin gently concave, heavily scaled for $\frac{3}{4}$ length.

Pectoral 1.1 in head, reaches above anal origin. Ventrals do not reach vent, 1.6 in head. Caudal moderately forked.

Scales strongly ctenoid. Lateral series about 65, l. tr. $\frac{10}{20}$ (l. l. to belly). Tubular lateral line scales 52. About 56 predorsal scales, extend to above nostrils. 10–12 cheek scales, and 5–6 more on preopercle flange. Anterior lateral line tubes bifid, single on peduncle.

COLOUR.—Dark brown, slightly lighter below. An indistinct fairly broad dusky stripe from opercle to caudal; traces of 2 narrow stripes above. Opercular spot doubtful. Fins all dusky, caudal darkest.

LENGTH.—Up to 177 mm.

LOCALITY.—Durban.

Two specimens taken on lines near Durban (H. W. Bell-Marley, 4/35).

This is the first record from South Africa of this Indian species.

Fowler ('Proc. Ac. Nat. Sci. Phil.', vol. lxxvii, p. 230, 1925) described as *striatus* G. & T. a specimen from Delagoa Bay. Actually that specimen was probably *stridens* (see Barnard, 'Ann. S. Afr. Mus.', vol. xxi, p. 680, 1927). Also Fowler ('Proc. Ac. Nat. Sci. Phil.', vol. lxxxvi, p. 467, fig. 39, 1934) has described two specimens as *striatus* G. & T. which cannot be that species, but are obviously conspecific with my present specimens. Actually my specimens and Fowler's differ in certain particulars

NEW RECORDS OF SOUTH AFRICAN FISHES. 187

from the usual diagnoses of *stridens*, and it is possible that they represent a new species. This cannot be determined with certainty without comparison with an Indian specimen of *stridens*. I have compared the specimens described above with one of *striatus* G. & T. of the same size; the two are certainly not conspecific. *P. stridens* is of much darker colour, has a smaller mouth, and a more robust but shallower body than *striatus*. Also the longitudinal stripes are much clearer in all stadia of the latter species than in *stridens*.

Family LABRIDÆ.

Pteragogus opercularis Peters. Text-fig. 5.

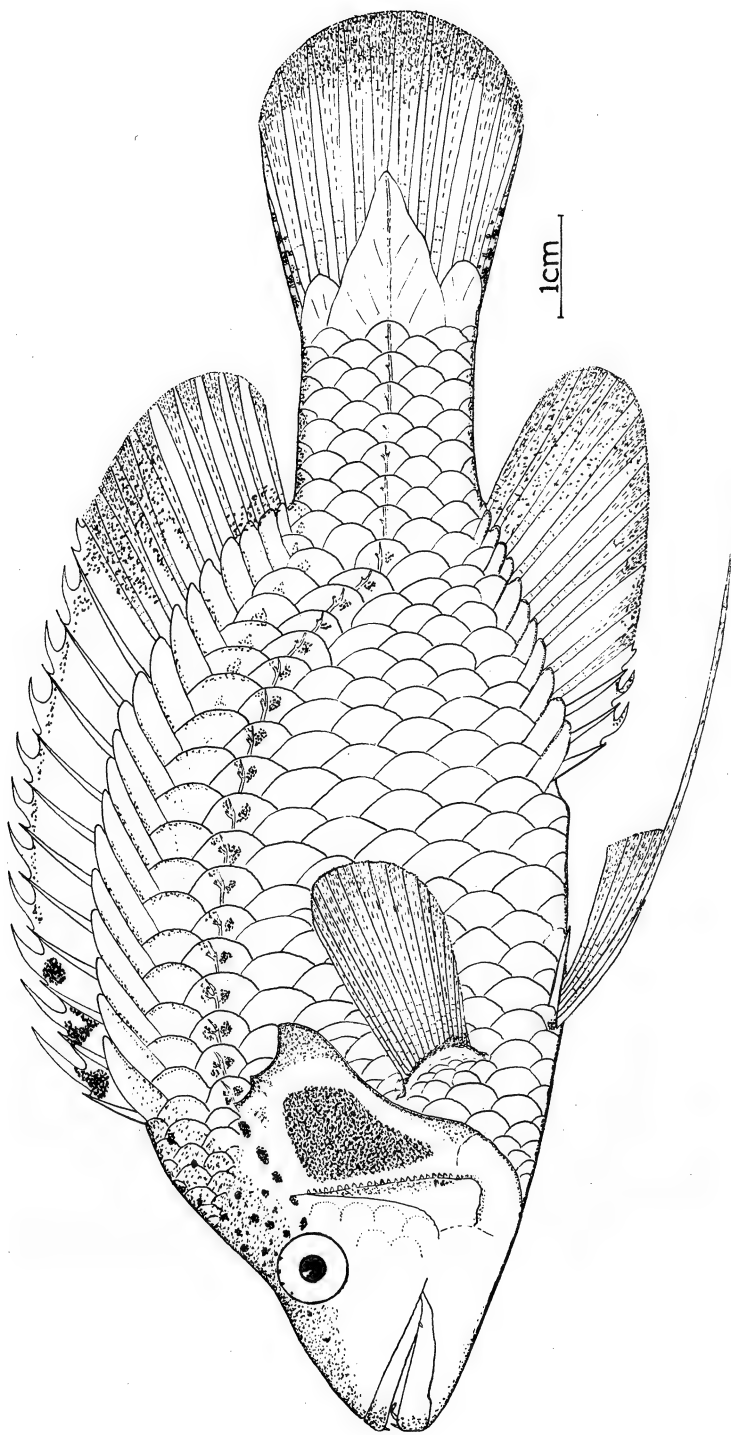
Pteragogus opercularis Peters; Barnard, Ann. S. Afr. Mus., vol. xxi, p. 754, 1927.

Body oblong, compressed. Dorsal profile concave before eye, nape prominent. Depth 2.3, length of head 2.8 in body length. Eye 6.0, snout 3.0, interorbital 5.2, and postorbital 2.0 in length of head. Preorbital depth slightly greater than eye. Maxilla completely concealed beneath preorbital, extends to below anterior margin of pupil. 4 anterior caniniform teeth in the front of each jaw, the median pair small and erect, the outer curved, flaring out and back. 2-3 small posterior canines at hind edge of upper jaw. A single series of stout conical teeth along the side of each jaw, close-set, forming a cutting edge. Outer gill-arch more or less reduced, rakers 5 or 6 on lower limb, rudimentary. Gill-membranes hidden below interopercles, united, form a moderate fold across the throat. Preopercle flange spinate, 24-26 spinules down to lower angle, lower margin entire.

D. XI, 9, inserted above middle of opercle, 1st spine 1.2 times eye, increase to the last, about 2.5 times eye. Membrane between spines extended, lobed. Anterior soft ray equal to last spine, increase to the 6th, 3 times eye, edge of fin rounded. Depressed rays reach caudal base.

A. III, 9, inserted below the last dorsal spines. Soft fin in shape and size like soft dorsal, depressed rays reach beyond caudal base.

TEXT-FIG. 5.



Pteragogus opercularis Peters.

NEW RECORDS OF SOUTH AFRICAN FISHES. 189

P. 13, 1·8 in head, rounded. Ventrals with first ray filamentous, 1·8 in body length; tip reaches almost to caudal base. Caudal broadly rounded.

Scales large, upper dorsal and lower ventral scales produced, forming a sheath for the dorsal and anal fins. Lateral line continuous, abruptly bent before peduncle. l. l. 24, l. tr. 2/6 (including dorsal sheath). Cheek scales concealed beneath thick, spongy skin. Opercular bones scaly, scales partly concealed. Lateral line tubes of anterior scales with an arborescent superior branch. 5 predorsal scales.

COLOUR.—Olive-green above, lighter below. Numerous dark spots on forehead and above and behind eye. A large ocellus covering most of opercle. Dark edges to scales above the lateral line. Fainter dark spots in a series above and below the lateral line tubes. A dark spot between each pair of the 1st–4th dorsal spines. Mid-posterior dorsal rays dusky. Caudal reddish. outer rays alternately light and dark. Iris golden.

LENGTH.—140 mm.

LOCALITY.—Durban (H. W. Bell-Marley, 4/35).

A single specimen of this species. Previously recorded from Mozambique by Peters in 1855, but not hitherto found in Natal waters.

Family GEMPYLIDÆ.

Thyrsitoides marleyi Fowler.

Thyrsitoides marleyi Fowler, Ann. Natal Mus., vol. vi, pt. 2, p. 255, fig. 2, 1929.

Skin very thin and papery. Body elongate, very compressed, tapers to peduncle. Depth 8·9, length of head 3·6 in length of body. Eye 7·0, snout 2·2, interorbital 5·4, and postorbital 2·6 in head length.

Mouth very large; lower jaw projects strongly; maxilla extends below anterior margin of eye. A single row of pointed trenchant teeth in each jaw. Anteriorly in the upper jaw several very large slender fixed pointed somewhat compressed teeth, one

smaller anteriorly, depressible. Vomer edentate, fine teeth on palatines. Tongue covered with minute teeth. Gill-rakers rudimentary, 4 or 5 fine bi- or trifold processes near angle on lower margin of anterior arch; remaining upper surface of arch with fine villiform teeth. Gill-membranes not united, free from isthmus. Nostrils wide apart, anterior small, circular, posterior slit-like. Free margin of preopercle round angle undulate, probably spinate in young. Interorbital with a longitudinal wide furrow.

D. XVIII, 12 + 5, originates above middle of opercle. Anterior spines longest, 1st 2·8, 2nd 2·3, 3rd and 4th broken, 5th 3·8 in head, thereafter shorter. Anterior rays falcate, 3·5 in head.

A. 13 + 4, inserted below soft dorsal; anterior rays falcate, somewhat lower than soft dorsal. Pectorals subfalcate, 2·5 in head. Ventrals close together, first (outer) ray longest, 3·5 in head. Caudal deeply forked, peduncle cylindrical.

Body largely covered with very fine cycloid scales. densest on nape, along back from peduncle. A patch behind eye, head otherwise naked. Two lateral lines, lower branching from upper. Upper runs from upper angle of operculum to the base of the 16th (left) or 17th (right) dorsal spine. On the right side this line has a break with a small inferior branch below the 13th dorsal ray. 190 scales in upper line (24 to where lower branch originates). The lower line originates just behind the base of the 4th dorsal ray, and curves down to run along the middle of the side to the caudal base. About 310 scales in the lower branch.

COLOUR.—Slaty-blue, shading to grey on belly. Membrane of spinous dorsal, and tips of caudal and pectoral black.

LENGTH.—590 mm.

LOCALITY.—East London.

A single specimen, presented by the Curator of the East London Museum. This is an interesting rediscovery of a species known hitherto only from the type, from which the present specimen differs only in minutiae, despite the disparity in size.

NEW RECORDS OF SOUTH AFRICAN FISHES. 191

Family SCOMBRIDÆ.

Sarda chilensis C. & V. Text-fig. 6.

Sarda chilensis C. & V.; Barnard, Ann. S. Afr. Mus., vol. xxi, p. 800, 1927.

Body fusiform, moderately compressed. Snout conical, pointed. Depth 4·5, length of head 3·5 in body length. Eye 6·0, snout 2·8, interorbital 3·4 and postorbital 2·0 in length of head. Preorbital depth half eye.

Mouth large, maxilla distally expanded, spatulate; extremity extends below hind margin of eye. 17–18 moderate compressed inwardly depressible acute teeth in a single series in each side of upper jaw. In lower jaw 4 or 5 large sub-conical depressible teeth anteriorly; along each side 5–6 large compressed inwardly depressible teeth, with a few smaller intermediate. Vomer edentate, palatines with fine sharp teeth. Gill-membranes united, free from isthmus. 8 gill-rakers plus one anterior rudiment on lower limb of anterior arch, longest 1·6 in gill-filaments, which are equal to eye. Adipose eyelids moderate, not to pupil. Interorbital broadly convex. with a slight median longitudinal furrow.

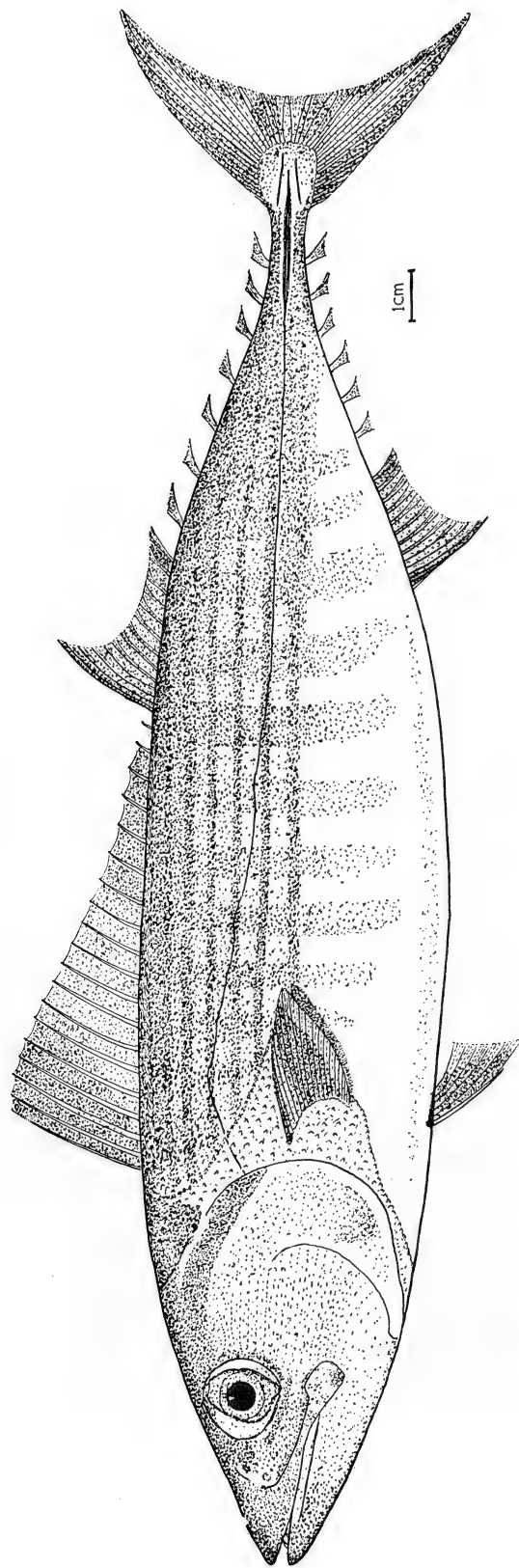
D. XIX, 14 + 7, inserted above hind margin of operculum. 1st spine 2·8, 2nd and 3rd subequal, longest 2·7 in head; remainder graduated shorter, last minute. Soft rays anteriorly falcate, highest 3·2 in head. Base of spinous dorsal 1·2 times head.

A. III, 12 + 6, inserted below end of base of continuous soft dorsal. In shape and size much as soft dorsal.

Pectorals 2·6 in head, ventrals 3·2 in head, inserted below pectorals. Caudal lunate. Peduncle depressed, with a single stout lateral keel, base of caudal with two auxiliary keels, one above and one below end of peduncular keel.

Scales minute, over whole body. Enlarged scales form a corselet over pectoral region, from isthmus up, embracing pectoral, extending up and forwards over nape; a long narrow extension back along base of spinous dorsal. Lateral line curves up over pectoral, thence obliquely down to peduncle.

TEXT-FIG. 6.



Sarda chilensis C. & V.

NEW RECORDS OF SOUTH AFRICAN FISHES. 193

COLOUR.—Steel-blue to black above, lighter below. Head blackish above, with curved dark post-orbital bar. Body with 6–7 narrow longitudinal dark stripes, longest along middle of side. 12–13 dusky cross-bars, slightly greater than interspaces fading out on abdomen. Spinous dorsal black anteriorly and posteriorly, mid-spines lighter. Soft dorsal dusky. Caudal dark with median light patch in each lobe. Pectorals with distal central dark patch, margin light. Ventrals dusky proximally. Anal and all finlets light.

LENGTH.—310 mm.

LOCALITY.—Durban.

A single specimen (a ripe female) (H. W. Bell-Marley, 978). Seldom taken in our area.

The Atlantic species sarda *C. & V.* is generally held to be distinct from chilensis *C. & V.*, chiefly in having 21 dorsal spines and the maxilla extending behind the hind margin of the eye. The two species are evidently very closely related, and comparison of equivalent stadia may eventually reveal that they are identical.

Family BLENNIIDÆ.

Blennius fascigula Barnard.

Blennius fascigula *Brnrd*; Smith, Rec. Alb. Mus., p. 152, pl. xvi, 1931; Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxxvii, p. 404, fig. 36, 1935 (*trifascigula*).

A specimen of this species, from Durban, has been received from Mr. Bell-Marley, who also sent to Fowler the specimens upon which was based the species *trifascigula* *Fowler* as distinct from *fascigula* *Barnard*. Fowler has evidently not seen the account of specimens of *fascigula* from East London (Smith, loc. cit.). I have compared the specimen from Durban with those from East London, and with the type of *fascigula*, and they are all without doubt conspecific. *trifascigula* is most certainly identical with both the Durban and the East London specimens, and cannot therefore be maintained as distinct.

Petroscirtes tapeinosoma *Blkr.*

Petroscirtes tapeinosoma *Blkr.*; Smith, Rec. Alb. Mus., vol. iv, p. 213, pl. xxi, B, 1935.

The first record from South Africa of this Indo-Pacific form was a specimen taken at Great Fish Point in 1934. Two specimens have recently been obtained in a rock-pool near East London, so that the species is evidently established in our area.

Family CLINIDÆ.

NOTE ON THE DISTRIBUTION OF SPECIES OF *CLINUS* *Cuv.* IN SOUTH AFRICA.

Until fairly recently it has been accepted that species of *Clinus* *Cuv.* were largely confined to the colder waters characteristic of the coasts of the west and south-western Cape. This was chiefly due to the fact that the only part of South Africa in which intensive collecting of these fishes had been carried out was that particular area.

Within the last few years investigation has shown that *Clinus* species extend very much further east into the warmer waters of the Indian Ocean than had previously been suspected. Quite a number have been found to occur regularly along the coast eastwards from False Bay, at least as far as East London. Quite recently I have found a number of *Clinus* species exceedingly abundant as far east as the mouth of the Great Kei River. It is most probable that continued investigation will show that these species extend even still further eastwards. One species, heterodon, *C. & V.*, has actually been traced as far as North Zululand (Smith, 1934).

The results of recent investigations merit a revised account of the distribution of *Clinus* species in South Africa, and this is summarized below.

NEW RECORDS OF SOUTH AFRICAN FISHES. 195

Clinus species.	Distribution.
<i>acuminatus</i> C. & V. . .	Walfisch Bay to False Bay.
<i>anguillaris</i> C. & V. . .	False Bay to Great Fish Point (S.): Durban (B.M.).
<i>agilis</i> J. L. B. Smith . .	Knysna estuary.
<i>brachycephalus</i> C. & V. .	False Bay to Keimouth (S.).
<i>brevicristatus</i> G. & T. .	False Bay ; Great Fish Point (S.).
<i>capensis</i> C. & V. . . .	Lambert's Bay (S.) to East London (S.): Durban (B.M.).
<i>cottoides</i> C. & V. . . .	Lambert's Bay (S.) to Durban (B.M.).
<i>dorsalis</i> Blkr.	Walfisch Bay to Keimouth (S.).
<i>fuorum</i> G. & T.	False Bay : Port Alfred (S.).
<i>heterodon</i> C. & V. . . .	False Bay to North Zululand (S.).
<i>laurentii</i> G. & T. . . .	Port Alfred (S.) to Zululand (B.M.).
<i>latipennis</i> C. & V. . . .	False Bay.
<i>mentalis</i> G. & T.	East London : Durban (B.M.).
<i>mus</i> G. & T.	False Bay to Keimouth (S.).
<i>ornatus</i> G. & T.	False Bay : Knysna (S.).
<i>pavo</i> G. & T.	False Bay (Great Fish Point): Keimouth (S.).
<i>robustus</i> G. & T.	Table Bay to East London (S.): Durban (B.M.).
<i>striatus</i> G. & T.	False Bay ; Port Alfred (S.) ; Durban (B.M.).
<i>superciliosus</i> Linn. . . .	Walfisch Bay to Durban (B.M.).
<i>taurus</i> G. & T.	Cape Peninsula : Plettenberg Bay (S.).
<i>venustris</i> G. & T.	False Bay : Knysna (S.).

Continuity of observed distribution is indicated by "to" between localities ; any considerable gap between recorded areas is indicated by a colon.

(B.M.) = extreme locality *vide* H. W. Bell-Marley.

(S.) = extreme locality *vide* J. L. B. Smith.

Other limits as given by Barnard ('Ann. S. Afr. Mus.', vol. xxi, pp. 852-866, 1927).

Nemacoclinus navalis Barnard.

Nemacoclinus navalis Barnard, Ann. S. Afr. Mus., vol. xxx, p. 646, fig. 1, 1935.

Body compressed, elongate. Depth 5.8, head 4.5 in body length. Snout pointed, sub-conical. Eye 4.3, snout 4.4, and interorbital 7.5 in head length.

Mouth moderate, maxilla extends to below middle of eye. Teeth in jaw subequal, minute teeth in a band on vomer. A short, apically dilated, fringed supraorbital tentacle. Mucous pores on head opening by a series of transversely opposed pores.

D. XXXIV, 1 originates over hind preopercle margin. Anterior three spines widely spaced, first two remote from third. 1st and 4th spines shortest, scarcely greater than eye, remainder subequal about 1.7 times eye. Soft ray shorter than last spine; membrane reaches caudal base.

A. II, 23; V, I, 3, inner ray small, adnate. Caudal rounded.

Lateral line complete, almost to caudal base; tubes with transverse tubes above and below, each opening by a pore, exactly opposed. 80 cross tubules.

COLOUR.—Olive-green, mottled red-brown, fins greenish.

LENGTH.—66 mm.

LOCALITY.—Great Fish Point.

A single specimen, taken in a rock pool.

This species has been known only from the type, taken at Simonstown. Its rediscovery at a point so far distant is of interest. Since the very intensive collecting of Clinids about the Cape Peninsula by the late W. Thompson, no new species have been taken in that area until *navalis* was discovered in 1934. During the past six years I have collected Clinid fishes most intensively from a stretch of rocks at Great Fish Point, so that had *navalis* been a normal inhabitant of that area, it could scarcely have escaped detection. Actually my specimen was taken only a short time after the discovery of the orthotype at Simonstown. In the circumstances it might be supposed that *navalis* has but recently appeared on our coasts.

Barnard has regarded *navalis* as generically distinct from *Clinus Cuv.* on the character of the lateral line, which in that latter genus is generally stated to have the lateral line tubes simple, opening by a single pore. Actually several species (e.g. *capensis* C. & V.) have at least the anterior portion of the lateral line of structure similar to that in *Nemacoclinus*.

Our species of *Clinus Cuv.* are in need of revision, since they fall into groups which appear to merit generic distinction, on

NEW RECORDS OF SOUTH AFRICAN FISHES. 197

grounds at least as valid as those accepted by Barnard for genera such as *Nemacoclinus Brnrd.*, *Clinoporus Brnrd.*, and *Petraites Ogilby.*

Family GOBIIDÆ.

Gobius callidus nom. nov.

Gobius gulosus *J. L. B. Smith*, Trans. Roy. Soc. S.A., vol. xxiv, pt. 1, p. 49, fig. 2, 1936.

It has been found that the name *gulosus* has previously been used for an American species of the genus, *callidus* is therefore proposed to replace *gulosus* for the South African species.

I wish to express my gratitude to the Research Grant Board of South Africa (Carnegie Fund) for financial assistance in this work.

Albany Museum,
Grahamstown ;
August, 1936.

EXPLANATION OF PLATE XI,

Illustrating Dr. J. L. B. Smith's paper, " New Records
of South African Fishes ".

Holocentrum sammara Forsk. × 1·7.



HOLOCENTRUM SAMMARA *Forsk.* X 1·7

INDEX TO VOLUMES I and II

Volume I ends at page 300

VALID SCIENTIFIC NAMES are in plain capitals.

Page in heavy type shows a description on that page.

Synonyms and Malidentifications are in italics.

An asterisk shows that there is an illustration on that page in the text.

- Acanthidium natalense* 272
ACANTHIDIUM QUADRISPINOSUM **270**, 271*-2
ACANTHOCEPOLA 173
ACANTHOCEPOLA CUNEATUS **171**-3 Pl. 21
ACANTHOCEPOLA LIMBATA 172
ACANTHOPAGRUS 307, 311, 313, **314**-5, 319
ACANTHOPAGRUS BERDA 311, 314, **315**-6*-7, 320 Pl. 18
ACANTHOPAGRUS BIFASCIATUS 311, 315, **317**-8*-320 Pls. 18, 24
ACTINISTIA 389, 391, 393, 412*, 415
ACUMINATUS, CLINUS 11, 297
ACUTIPENNIS, GOBIUS 386
ADENI, PERISTEDION 69, **71**-3 Pl. 22
AENEOFUSCUS, GOBIUS 233, **234**
AEROSTATICUS, (TETRODON) 208
AESTUARIUS, (ACANTHOPAGRUS) 317
AESTUARIUS, GILCHRISTELLA **235**
AENEUM, PACHYMETOPON 311, 363, **364** Pls. 22, 29; p. 526
AFER, BARBUS 267
AFRICANA, TRIGLA (TRIGLOPORUS) **73**, **74**-6 Pl. 23
AGILIS, CLINUS **10**, **11** Pl. 16; p. 297
AGONOSTOMUS 79
ALBOFASCIATUS, BATRICHTHYS **59**, 60 Pl. 5
ALBULA VULPES 51
albus, *Dentex* 370, 373
ALEPISAUROIDAE 154
ALEPISAUROS FEROX **154**
ALGOAE, CAESIO **173**
ALTAVELA, (PTEROPLATEA) 46, 47
ALUTERES 238, **240**-1
ALUTERES MONOCEROS 238, 240, **241**-4 Pls. 40, 41, 43
ALUTERES SCRIPTUS 240-1, **243**-4 Pl. 42
ALUTERIDAE 238, **239**
AMBLYAPISTUS BINOTATA **543**
AMBLYAPISTUS MARLEYI **12**
Amblyapistus marleyi 543
AMIA 501
Amphiprionichthys zeylonicus 13
AMPHIPRIONIDAE 183
ANABAS **230**
ANABAS BAINSII 230, **231** Pl. 33
ANABAS CAPENSIS **230**-1, 237 Pl. 33
ANABAS SCANDENS 230
ANABAS TESTUDINEUS 230
Anabas vicinus 231
ANABATIDAE 218, **230**
ANGLICUS, CHRYSOBLEPHUS 311, 340-1, **347**-8*, 380 Pls. 19, 24; p. **526**
ANGUILLA MOSSAMBICA **227**
ANGUILLARIS, CLINUS 11, 197, 297
ANGUILLARIS, PLOTOSUS **226** Pl. 34
ANGUILLIDAE **218**, 227
ANOPLUS, BARBUS 219, **220**, 231 Pl. 29; p. 267
APHAREUS 535
APLOACTIDAE 202
AQUILA, (MYLIOBATIS) 147, 148
ARGENTATUS, (CLINUS) 197
ARGYROGRAMMICUS, PRISTIMOIDES **285**, 286*-7
ARGYROPS 305, 311, 313, **333**, 370, 525
ARGYROPS FILAMENTOSUS 311, **333**-**335**, **525**
ARGYROPS SPINIFER 311, 333, **334**-5 Pls. 20, 25; p. **525**
ARGYROZONA **374**, **378**
argyrozona, *Dentex* 378
ARGYROZONA, POLYSTEGANUS 308*, 368, 374, **378** Pls. 21, 27
ARMATUS, (GRAMMONUS) 53
ATER, (GRAMMONUS) 53
ATHERINIDAE 156
ATLANTICUS, (HOPISTETHUS) 162
atricauda, (*Sardinella*) 150
auratus, *Mugil* 80-1, 106, 108, 120, 122-3
AURATA, (SPARUS) 314, 320
AURIVENTRIS, AUSTROSPARUS 308*, 311, 319-**325***, 326*-7, 362 Pls. 18, 23; p. 512
auriventris, *Austrosparus* 545-548
auriventris, *Diplodus* 325, 547
AUROLINEATUS, GNATHODENTEX **398**, 541
AUSTRALIS, (ACANTHOPAGRUS) 315, 320
AUSTROSPARUS 307, 311, 313, 315, **319**-321, 327, 330, 545, **546**-7
AUSTROSPARUS AURIVENTRIS 308*, 311, 319-**325***, 326*-7, 362 Pls. 18, 23; p. 512
Austrosparus auriventris 545-548
AUSTROSPARUS GLOBICEPS 311, 320, **321**-2*-3, 327-8 Pls. 18, 23; p. 545, **546**-9
AUSTROSPARUS SARBA 311, 319-**323**-4*, 327-8 Pls. 18, 23; p. 545-6, **547**-9
Austrosparus sarba 325
AUSTROSPARUS TRICUSPIDENS 546, **548**-9
AXELIA 425, 447
AXELIA ROBUSTA 501, 505
AXILLARIS, (CAESIO) 174

- AXILLARIS, DASYLLUS 183-5 Pl. 22
AXINECEPS 374, 379
- BAGRIDAE 218, 225
BAHIENSIS, (CYPSELURUS) 160
BAINSII, ANABAS 230, 231 Pl. 33
BALINENSIS, HEMIRHAMPHUS 22-3, 33-4
BALISTES CONSPICILLUM 210
BALISTIDAE 210, 238-240
BARBUS 218, 219
BARBUS AFER 267
BARBUS ANOPLUS 219, 220, 231 Pl. 29; p. 267
BARBUS BROOKINGI 219, 221 Pl. 30
BARBUS BURCHELLI 219, 223 Pl. 30
BARBUS CAPENSIS 219, 221 Pl. 30
BARBUS GILCHRISTI 219, 222 Pl. 29
BARBUS, HEMIPLEUROGRAMMA 219, 223 Pl. 29
BARBUS HOLUBI 216, 219, 222 Pl. 31
BARBUS PALUDINOSUS 219, 221 Pl. 30
BARBUS SENTICEPS 219, 220*, 266*
BARBUS TREVELYANI 219 Pl. 29
BARBUS VULNERATUS 219, 223 Pl. 31
barnardi, *Myxus* 81, 90, 93
BARNARDI, SYNAPTURA 4, 5* Pl. 16
BATRACHOIDES 59
BATRACHOIDIDAE 49, 58
BATRICHTHYS 49, 58-9
BATRICHTHYS ALBOFASCIATUS 59, 60 Pl. 5
belanak, *Mugil* 129
BENNETTI, (POMADASY) 181, 182
BERDA, ACANTHOPAGRUS 311-315-6*-7, 320 Pl. 18
BIDENICHTHYS 566
BIDENICHTHYS CAPENSIS 566
BIFASCIATUS, ACANTHOPAGRUS 311, 315, 317-8*-320 Pls. 18, 24
bifasciatus, (*Austrosparus*) 323, 547
BIFILUM, BLENNIUS 190-1 Pl. 20
BINOTATA, AMBLYAPISTUS 543
bipinnulatus, *Elacate* 178
BITORQUATUS, GYMNOCRANIUS 536, 537
bleekeri, *Doryichthys* 49
BLENNIIDAE 8, 189, 295
BLENNIUS 191
BLENNIUS BIFILUM 190-1 Pl. 20
BLENNIUS CORNUTUS 189
BLENNIUS FASCIGULA 8 Pl. 16; p. 295
Blennius trifascigula 295
BLOCHII, PACHYMETOPON 311, 363-4 Pls. 22, 28, 29
BOOPSOIDEA 304-5, 311, 350, 351
BOOPSOIDEA INORNATA 311, 351-2 Pls. 22, 28
borneensis, *Mugil* 120
BORO, PISOODONOPHIS 273
BOX 304-5
BRACHYCEPHALUS, CLINUS 11, 297
BRACHYURUS, MICROPHIS 49*, 50
BREVIORESTATUS, CLINUS 11, 297
BREVIPINNIS, SCYMNORHINUS 253-4*-5
BROOKINGI, BARBUS 219, 221 Pl. 30
BROTULA PALMIETENSIS 198 Pl. 21
BROTULIDAE 52-3, 198, 306, 566
- BUCHANANI, MUGIL 81-2, 89, 113-4*-5, 131 Pls. 16, 20
BURCHELLI, BARBUS 219, 223 Pl. 30
- caeruleomaculatus*, *Mugil* 95, 113, 115
CAERULEOMACULATUS, MUGIL 128, 130-1
CAESIO ALGOAE 173
calabarius, (*Hemirhamphus*) 36, 39
calabarius schlegeli, *Hemirhamphus* 39
CALLIDUS, GOBIUS 223-4*, 299
CALLIONYMIDAE 165
CANADUS, RHACHICENTRUM 177-8
CANALICULATUS, MUGIL 81-2, 89, 113, 120-2*-3, 130, 132 Pls. 16, 17, 18
CANARIENSIS, (PTEROPLATEA) 46
CANESCENS, PACHYMETOPON 311, 363-4
CANTHARUS 304
CAPENSIS, ANABAS 230-1, 237 Pl. 33
CAPENSIS, BARBUS 219, 221 Pl. 30
CAPENSIS, BIDENICHTHYS 566
capensis, *Champsodon* 192
CAPENSIS, CHELIDONICHTHYS 68
CAPENSIS, CLINUS 11, 297-8
capensis, *Coracinus* 138, 144
CAPENSIS, DICHISTIUS 137-139, 143-6 Pl. 13; p. 301-2 Pl. 10; p. 557-8*-9
CAPENSIS, DIPLODUS 150, 331
capensis, *Dipterodon* 138-9, 144
CAPENSIS, HIPPOCAMPUS 149, 150
CAPENSIS, LABEO 224 Pl. 31
CAPENSIS, MERLUCCIUS 158, 206
capensis, *Mugil* 108, 110
CAPITO, MUGIL 79, 83, 88, 102, 103-4*-5*-7, 110, 131 Pls. 17, 19
CARACANTHUS ZEYLONICUS 13
CARANGIDAE 174, 279
CARANTHUS 304-5
CARANX 280
CARANX GYMNOTETHOIDES 279, 280
CARPIO, CYPRINUS 224
cauda lunata, (*Coracinus*) 138
CENTRARCHIDAE 218, 237
cephalotus, (*Mugil*) 90
CEPHALUS, MUGIL 79, 81, 83, 88, 90, 91*-5, 123, 130, 132 Pl. 15; p. 232*
CEPOLIDAE 171
CERVINUS, DIPLODUS 170
CERVUS, MYLIOBATIS 147, 148*
CESTRAEUS 79
CETOMIMIDAE 158
CETOMIMUS PICKLEI 158-9
ceylonensis, *Mugil* 81, 113, 115
Chaetodipterus 188
CHAETODIPTERUS 246
Chaetodipterus faber 187-8
Chaetodipterus goreensis 188, 248, 250-2
Chaetodipterus orbis 188, 250
Chaetodon cingulatus 284
CHAETODON KLEINII 284
CHAETODON MARLEYI 176-7 Pl. 22
Chaetodon nigripinnatus 282, 284
CHAETODON SETIFER 247
CHAETODON TRIFASCIATUS 280-1
CHAETODON XANTHOCEPHALUS 282-3*
CHAETODONTIDAE 176, 246-7, 280

- CHALUMNAE, LATIMERIA 387-8*-390,
391-4 Pls. 3-7, 403-5*-7*-8-409-415 Pls.
1-3; p. 425-426-522 19 figs. 44 pls.
- CHAMPSODON CAPENSIS 192
- CHARAX 304-5
- CHEIMERIUS 368, 370
- CHEIMERIUS NUFAR 368, 370-1*-3 Pls.
21, 27
- CHELIDONICHTHYS 61, 68
- CHELIDONICHTHYS CAPENSIS 68
- CHELIDONICHTHYS KUMU 68
- CHELIDONICHTHYS QUEKETTI 68*
- CHILENSIS, SARDA 293, 294*-5
- CHORISOCHISMUS DENTEX 563
- CHRYSOBLEPHUS 311, 314, 320, 331, 335,
338, 339-40, 551
- CHRYSOBLEPHUS ANGLICUS 311, 340-1,
347-8*, 380 Pls. 19, 24; p. 526
- CHRYSOBLEPHUS CRISTICEPS 311, 340-
342*-7 Pls. 20, 26; pp. 551, 552*-6
Chrysoblephus cristiceps 343
- CHRYSOBLEPHUS GIBBICEPS 311, 337,
340-1, 345-7 Pls. 19, 26
- CHRYSOBLEPHUS LATICEPS 311, 340,
341 Pls. 19, 26
- CHRYSOBLEPHUS LOPHUS 311, 340-1,
346-7, 551
- CHRYSOBLEPHUS PUNICEUS 311, 340-1,
343-4*-5, 526, 551-2, 554-5*-6
- CHRYSOPHRYS 304
Chrysophrys haffara 547
Chrysophrys natalensis 323, 547
Chrysophrys sarba 547
- CICHLIDAE 84, 218, 228
- CILIARIS, PAGRUS 334
cingulatus, *Chaetodon* 284
- CLARIAS 225
- CLARIAS GARIEPINUS 225
- CLINIDAE 10, 195, 296
- CLINOPORUS 299
- CLINUS 51, 197, 296-8
- CLINUS ACUMINATUS 297
- CLINUS AGILIS 10-1 Pl. 16; p. 297
- CLINUS ANGUILLARIS 297
- CLINUS BRACHYCEPHALUS 11, 297
- CLINUS BREVICRISTATUS 11, 297
- CLINUS CAPENSIS 11, 297-8
- CLINUS COTTOIDES 297
- CLINUS DORSALIS 11, 297
- CLINUS FUCORUM 297
- CLINUS HETERODON 195 Pl. 22; pp. 296-7
- CLINUS LATIPENNIS 297
- CLINUS LAURENTII 196-8*, 297
- CLINUS MENTALIS 197, 297
- CLINUS MUS 11, 297
- CLINUS ORNATUS 11, 197, 297
- CLINUS PAVO 11, 297
- CLINUS ROBUSTUS 196, 297
- CLINUS STRIATUS 11, 197, 297
- CLINUS SUPERCILIOSUS 11, 297
- CLINUS TAURUS 196, 297
- CLINUS VENUSTRIS 196, 297
- CLUPEIDAE 150, 218, 235
- COCCOTROPUS 202
- COCCOTROPUS JUBATUS 201 Pl. 18
- COELACANTH *see* LATIMERIA
CHALUMNAE
- COELACANTHIDAE 388*-9, 393-4,
413-4*-5, 420-422
- COELACANTHUS GRANULATUS 437
- COERULEOPUNCTATUS, POLYSTEGA-
NUS 368, 373, 374-6 Pls. 22, 28
commersoni, (*Hemirhamphus*) 24
- COMMERSONI, (SCOMBEROMORUS) 189
- COMPRESSUS, MUGIL 81, 89, 115-7*-8,
131 Pls. 17, 20
- CONGIOPODUS TORVUS 51
- CONSPICILLUM, BALISTES 210
conspicillum, *Pachynathus* 210
constantiae, *Mugil* 90
Coracinus 137-8
Coracinus capensis 138, 144
- CORNUTA, (MYLIOBATIS) 147
- CORNUCUS, BLENNIUS 189
- CORYPHAENOIDIDAE 154
- CORYZICHTHYS 59, 60
- COTTOIDES, CLINUS 11, 297
- CRENIDENS 304-5, 311, 357, 360
- CRENIDENS CRENIDENS 311, 360, 361*
Pls. 22, 26
- CRENIDENS, CRENIDENS 311, 360, 361*
Pls. 22, 26
- CRENILABIS, MUGIL 88, 99*, 100, 130,
274-5
- CRISTICEPS, CHRYSOBLEPHUS 311,
340-1, 342*-7 Pls. 20, 26; pp. 551, 552*-6
cristiceps, *Chrysoblephus* 343
- CRISTICEPS, POLYAMBLYODON
(LEPTOMETOPON) 527*, 528-9*, 530*-2
Pl. 50
- CROSSOPTERYGII 411, 412*, 415
- CUBICEPS NATALENSIS 200
- CUNEATUS, ACANTHOCEPOLA 171-3
Pl. 21
- CUNNESIUS, MUGIL 129, 130
cunnesius, *Mugil* 81, 96, 98
- CURVIDENS, GYMNOCROTAPHUS 311,
358*
- CUVIERI, (ACANTHOPAGRUS) 315
- CYMATOCEPS 311, 314, 337-8
- CYMATOCEPS NASUTUS 311-2, 338-9*,
382 Pls. 20, 25; p. 512
- CYPRINODONTIDAE 272
- CYPRINIDAE 218, 266
- CYPRINUS 218, 224
- CYPRINUS CARPIO 224
- CYPSELURUS HEWITTI 159
- CYPSILURUS 26
- DALATIAS 253
- DALATIAS LICA 255
- DALGLEISHI, XENOLEPIDICHTHYS
162-3 Pl. 18
- DARWINI, GEPHYROBERYX 162
- DASYLLUS AXILLARIS 183-5 Pl. 22
- DASYBATIDAE 43
- DECAPTERUS LAJANG 174-5 Pl. 21
- DELAGOAE, HEMIRHAMPHUS 22-3, 31-4
Pls. 10, 12
- DELAGOAE, NEMIPTERUS 542
- DENTATA, PORCOSTOMA 311, 349, 350
Pls. 20, 25
- DENTEX 183, 304-5, 367-8, 370, 373, 381,
399, 533, 536
Dentex albus 370, 373
Dentex argyrozona 378
- DENTEX, CHORISOCHISMUS 563

- Dentex filamentosus* 399
Dentex filiosus 370, 372, 376, 556
Dentex lineopunctatus 374–6
 DENTEX MATSUBARAE 367
Dentex miles 370, 373
Dentex natalensis 374
Dentex nufar 370, 371, 373
 DENTEX PERONII 367
Dentex rivulatus 533, 537, 541
Dentex robinsoni 533, 537
Dentex rupestris 371
Dentex variabilis 371
 DENTICIDAE 303, 308*–9, 337, 366–8, 381, 532–534, 556
 DERMATOPSIS 566, 568
 DERMATOPSIS KASOUGAE 566–7*–8
 DERMATOPSIS MICRODON 568
 DERMATOPSIS MULTIRADIATUS 568
 DIABOLUS, MOBULA 561, 569
diadema, *Mugil* 81, 115, 117–8
 DIAPHUS 17–19
 (DIAPHUS) ELUCENS, MYCTOPHUM 152–3*
 DICHISTIIDAE 135, 137, 301, 557
 DICHISTIUS 135, 136, 137, 138, 302
 DICHISTIUS CAPENSIS 137–139, 140, 143–6 Pl. 13; pp. 301–2 Pl. 10; pp. 557–8*–9
 DICHISTIUS FALCATUS 138–9, 141, 142–4 146 Pls. 14, 17
 DICHISTIUS MULTIFASCIATUS 138–9, 141, 144–6 Pls. 15, 16
 DIPLOCERCIDES 421
 DIPLOCERCIDES KAYSERI 477
 DIPLODUS 304–5, 307, 311, 313–5, 319, 321, 327, 330–1, 546
Diplodus auriventris 325, 547
Diplodus capensis 150
 DIPLODUS CERVINUS 170
 DIPLODUS SARGUS 311, 320, 331–2* Pls. 19, 24
 DIPLODUS TRIFASCIATUS 311, 331, 332–3* Pls. 19, 24
Dipterodon 137–8
Dipterodon capensis 138–9, 144
 DORSALIS, CLINUS 11, 297
Doryichthys bleekeri 49
 DREPANE 137, 245–6, 252
 DREPANIDAE 245–247
Drepanoscorpis 137–8, 146
Drepanoscorpis gilchristi 138, 144, 146
Dulosparus 334
 DURBANENSIS, SPARODON 311, 321, 328–9*–330 Pls. 18, 23
durbanensis, *Sparus* 328
 DUSSUMIERI, HEMIRHAMPHUS 23, 30–1, 34

 ECHINORHINIDAE 253
 ECHINORHINUS 253
 ECKLONIAICHTHYS 561
 ECKLONIAICHTHYS SCYLLIORHINI-CEPS 561–2*–3
Elacate 178
Elacate bipinnulatus 178
Elacate nigra 177
Elagatis 178
 ELEOTRIDAE 264
 ELEOTRIS LIMOSUS 264–5 Pls. 4, 5
 ELEOTRIS MADAGASCARIENSIS 265
 ELEOTRIS OPHIOCEPHALUS 265
 ELOPS 79
 ELUCENS, MYCTOPHUM (DIAPHUS) 152–3*
 EMARGINATUM, SPONDYLIOSOMA 311, 362 Pls. 22, 29
engeli, *Mugil* 97–8
 EPHIPPIDAE 245–6
 EPHIPPINAE 248
 EPHIPPUS 245–7, 248*–9
 EPINEPHELUS 80
 EPINEPHELUS FLAVOCAERULEUS 168 Pl. 22
 ERYTHRORINCHUS, (HEMIRHAMPHUS) 31
 EURONOTUS, MUGIL 81–4, 88, 100–1*–3, 110, 123, 131, 133 Pls. 16, 17, 19; p. 232*, 233
 EXOCOETIDAE 41, 159

faber, *Chaetodipterus* 187–8
 FALCATUS, DICHISTIUS 138–9, 141, 142–4, 146 Pls. 14, 16
 FALCIFORMIS, MONODACTYLUS 235 Pl. 34
 FAR, HEMIRHAMPHUS 22–3, 24–8, 30, 40 Pls. 10, 12
 FARIO FARIO, SALMO 236, 237
 FARIO IRIDEUS, SALMO 236, 237
 FARIO, SALMO FARIO 236, 237
fasciatus, *Hemirhamphus* 24, 27
 FASCIGULA, BLENNIUS 8 Pl. 16; p. 295
 FAUREI, LEPIDOTRIGLA 62, 63–5 Pls. 16, 18, 19
 FEROX, ALEPISAURUS 154
fidjiensis, (*Setarches*) 57, 58
 FILAMENTOSUS, ARGYROPS 311, 333–335, 525
filamentosus, *Dentex* 399
filamentosus, *Pristipomoides* 287
filosus, *Dentex* 370, 372, 376, 556
 FITZSIMONSI, HALIEUTEA 211–2 Pl. 23
fitzsimonsi, *Halieutichthys* 211
 FLAVOCAERULEUS, EPINEPHELUS 168 Pl. 22
 FLORENTII, MYCTOPHUM (NASO-LYCHNUS) 18 Pl. 9
frenatus, *Gymnocranius* 536, 537
 FUCORUM, CLINUS 11, 297

 GADIDAE 158, 306
 GALAXIAS 236
 GALAXIAS ZEBRATUS 236 Pl. 34
 GALAXIIDAE 218, 236
 GARIEPINUS, CLARIAS 225
 GEMPYLIDAE 291
 GEORGII, (HEMIRHAMPHUS) 38
 GEPHYROBERYX DARWINI 162
 GEPHYROGLANIS 225, 226
 GEPHYROGLANIS SCLATERI 226 Pl. 33
 GERMANUM, POLYAMBLYODON 311, 366
 GERMANUS, POLYAMBLYODON (POLYAMBLYODON) 527, 528
 GIBBICEPS, CHRYSOBLEPHUS 311, 337, 340–1, 345–7 Pls. 19, 26
 GIBBOSUM, PACHYMETOPON 526–7

- GIBBOSUS, LACTOPHRYS **209**
 GIBBOSUS, POLYAMBLYODON (LEPTO-METOPON) **528** 531
gigas, (*Myctophum*) 152-3
 GILCHRISTELLA **235**
 GILCHRISTELLA AESTUARIUS **235**
 GILCHRISTI, BARBUS 219, **222** Pl. 29
gilchristi, *Drepanoscorpis* 138, 144, 146
 GILCHRISTI, HOPLOSTETHUS **160-2** Pl. 22
 GIRELLIDAE 135-6, 246, 305, 360
 GIURIS, GOBIUS 233, **234**, 263
 GLAUCOSOMA PEAOLOPESI **396-7***
 GLAUCUM, PACHYMETOPON 311, 363, **365-6**
 GLOBICEPS, AUSTROSPARUS 311, 320, **321-2***-3, 327-8 Pls. 18, 23; p. 545, **546-9**
 GNATHODENTEX 534-6, **541**
 GNATHODENTEX AUROLINEATUS **398**
 GOBIESOCIDAE 561
 GOBIIDAE 193, **218**, 233, 259, 299, 385, 564
 GOBIUS 194, **233**
 GOBIUS ACUTIPENNIS 386
 GOBIUS AENEOFUSCUS 233, **234**
 GOBIUS CALLIDUS **233**, **234***, **299**
 GOBIUS GIURIS 233, **234**, 263
 GOBIUS GULOSUS **261-2***-3, 299
 GOBIUS KEIENSIS **385-6***
 GOBIUS VONBONDEI **259-261*** Pls. 3, 5
gorensis, *Chaetodipterus* 188, 248, 250-2
gracile, *Peristedion* 69-71
 GANGENE, (CORYZICHTHYS) 59, 60
graminis, (*Clinus*) 195
 GRAMMICOLEPIDAE 1, 162, 187
 GRAMMONUS 52
 GRAMMONUS OPISTHODON **52** Pl. 6
 GRANDE, PACHYMETOPON 311, 363, **365-6**, 526
 GRANDOCULIS, (MONOTAXIS) **542**
 GRANUALTUS, COELACANTHUS **437**
 GRISEUS, GYMNOCRANIUS 532-3, 536, **537**, 539*-541 Pl. 58
 GRUNNIENS, (BATRICHTHYS) 59
 GUENTHERI, (SETARCHES) 58
 GULOSUS, GOBIUS **261-2***-3, 299
 GÜNTHERI, SETARCHES **57-8** Pl. 6
 GURNADUS, (TRIGLA) 73-5
 GYMNOCRANIUS 305, 367-**369**, 532-**536-7**, 541-2
 GYMNOCRANIUS BITORQUATUS 536, **537**
Gymnocranius frenatus 536-7
 GYMNOCRANIUS GRISEUS 532-3, 536, **537**, 539*-541 Pl. 58
Gymnocranius microdon 536-7
Gymnocranius rivulatus 533
 GYMNOCRANIUS ROBINSONI 368, **369**
 Pls. 21, 27; p. 532
Gymnocranius robinsoni 533, 536-7, 541
 GYMNOCRANIUS RUPPELLII 533, 537, **541**
 GYMNOCROTAPHUS 304-5, 311, 357, **358**, 529
 GYMNOCROTAPHUS CURVIDENS 311, **358***
 GYMNOSTETHOIDES, CARANX **279**, 280
 HALIEUTEA 212
 HALIEUTEA FITZSIMONSI **211-2** Pl. 23
 HALIEUTICHTHYS 212
Halieutichthys fitzsimonsi 211
 HAPLOCHILUS KATANGAE **272**
 HAPLOCHILUS MYAPOSAE 273
 HAPLOCHROMIS 230
 HAPLOCHROMIS MOFFATI **230** Pl. 32
 HAPLODACTYLUS, (SCORPAENA) 203
 HEMIPLEUROGRAMMA, BARBUS 219, **223** Pl. 29
 HEMIRHAMPHIDAE 40-2
 HEMIRHAMPHUS **21-2**, 40-1
 HEMIRHAMPHUS BALINENSIS 22-3, **33-4**
Hemirhamphus calabaricus schlegeli 39
 HEMIRHAMPHUS DELAGOAE 22-3, **31-4**
 Pls. 10, 12
 HEMIRHAMPHUS DUSSUMIERI 23, **30-1**, 34
 HEMIRHAMPHUS FAR 22-3, **24-8**, 30, 40
 Pls. 10, 12
Hemirhamphus fasciatus 24, 27
 HEMIRHAMPHUS IMPROVISUS 22, 24, **34-5***-6, 38 Pl. 11
 HEMIRHAMPHUS KNYSNAENSIS 22, 24, **35***, **36-8**, 40 Pls. 10, 11
 HEMIRHAMPHUS MARGINATUS 22-3, **27-29**
 HEMIRHAMPHUS SCHLEGELI 22, 24, **35-6**, 38, **39**, 40
 HETERODON, CLINUS **195** Pl. 22; p. 296-7
 HEWITTI, CYPSELURUS **159**
 HEWITTI, PRIONOLEPIS **1**, **3***
hewitti, *Prionolepis* 187
 HIPPOCAMPUS CAPENSIS **149**, 150
hoeferi, *Mugil* 122
 HOLOCENTRIDAE 275
 HOLOCENTRUM SAMMARA **275** Pl. 11
 HOLUBI, BARBUS 216, 219, **222** Pl. 31
 HOLUBI, SARGUS 327
 HOPLEGNATHIDAE 169
 HOPLEGNATHUS ROBINSONI **169-170**
 Pl. 18
 HOPLOSTETHUS GILCHRISTI **160-2** Pl. 22
 HORRIDA, SYNANCEIA **543-4**
Hyporhamphus 21-2
 IMPROVISUS, HEMIRHAMPHUS 22, 24, **34-6**, 38 Pl. 11
 INDICA, (ACANTHOCEPOLA) 172
 INDICUS, PLATYCEPHALUS **204-6** Pl. 20
 INDICUS, PSENIUS 53
 INORNATA, BOOPSOIDEA 311, **351-2** Pls. 22, 28
insidator, *Platycephalus* 204
 IRIDEUS, SALMO FARIO 236, **237**
 ISO NATALENSIS **156-7**
 ITOSIBI, NEOTHUNNUS **185***
 JACKSONI, TAENIOIDES **564-5***-6
 JABATUS, COCCOTROPUS **201** Pl. 18
 KASOUGAE, DERMATOPSIS **566-7***-8
 KATANGAE, HAPLOCHILUS **272**
 KAYSERI, DIPLOCERCIDES 477
haffara, *Chrysophrys* 547

- KEIENSIS, GOBIUS 385-6*
kelaartii, Mugil 97-8
 KLEINII, CHAETODON 284
 KNYSNAENSIS, HEMIRHAMPHUS 22, 24,
 35*, 36-8, 40 Pls. 10, 11
 KNYSNAENSIS, PSAMMOGOBIUS 193-4
 KNYSNAENSIS, SERRANUS 167
 KOWIENSIS, SCORPAENA 202-3
 KUDA, (HIPPOCAMPUS) 150
kuhli, *Mobula* 569
 KUMU, CHELIDONICHTHYS 68
 KYPHOSIDAE 135-7, 247 305
 KYPHOSUS 136-7
- LABEO 218, 224
 LABEO CAPENSIS 224 Pl. 31
 LABEO UMBRATUS 224, 225 Pl. 31
 LABIOSUS, MUGIL 129-30
 LABRIDAE 289
 LACTOPHRYS 210
 LACTOPHRYS GIBBOSUS 209
 LACTOPHRYS QUADRICORNIS 209 Pl. 22
Lactoria 210
 LAGOCEPHALUS, TETRODON 207-8 Pl.
 20
 LAJANG, DECAPTERUS 174-5 Pl. 21
 LAMPADENA 17
 LAMPANYCTUS 17
 LANIARIUS, PTEROGYMNUS 311, 335,
 336*-7 Pls. 19, 25; p. 526
 LATICEPS, CHRYSOBLEPHUS 311, 340,
 341 Pls. 19, 26
 LATIMERIA 422-6, 461, 471, 501
 LATIMERIA CHALUMNAE 387-8*-390,
 391-4 Pls. 3-7; pp. 403-5*-7*-8, 409-415
 Pls. 1-3; pp. 425, 426-522 19 figs, 44 p's.
 LATIPENNIS, CLINUS 297
 LATOVITTATUS, MALACANTHUS 395
 LATUS, (ACANTHOPAGRUS) 315
 LAURENTII, CLINUS 196-8*, 297
laurentii, *Petraites* 196
 LEPIDOTRIGLA 61, 64
 LEPIDOTRIGLA FAUREI 62, 63-5 Pls. 16,
 18, 19
 LEPIDOTRIGLA MULTISPINOSUS 62,
 66-7 Pls. 17, 20
 LEPIDOTRIGLA NATALENSIS 62, 64, 65
 Pls. 16, 18, 19
 LEPTOCEPHALUS 227-8
 LEPTOMETOPON 528
 (LEPTOMETOPON) CRISTICEPS, POLY-
 AMBLYODON 527*, 528-9*, 530*-2 Pl. 50
 (LEPTOMETOPON) GIBBOSUS, POLY-
 AMBLYODON 528, 531
 LETHRINIDAE 533-535
lichia, *Dalatias* 255
 LICHIA, SCYMNORHINUS 255
lichia, *Scymnorhinus* 255
 LIMBATA, ACANTHOCEPOLA 172
 LIMOSUS, ELEOTRIS 264-5 Pls. 4, 5
 LINEATA, (TRIGLA) 73-6
 LINEOLATUS, SCOMBEROMORUS 188-9
 LINEOLATUS, (SYNCHIROPUS) 167
lineopunctatus, *Dentex* 374-6
liogaster, (*Halieutea*) 211-2
 LIONURUS NASUTUS 154-5*
 LIRUS 56
 LITHOGNATHUS 311, 351-2, 354
 LITHOGNATHUS LITHOGNATHUS 311,
 350, 354, 355
 LITHOGNATHUS, LITHOGNATHUS 311,
 350, 354, 355
 LITHOGNATHUS MORMYRUS 311, 355,
 356* Pls. 20, 29
 LITHOGNATHUS, PAGELLUS 182
 LITHOPHILUS, NEOSCORPIS 7
Liza 79
longimanus, *Mugil* 96-8, 113
 LOPHUS, CHRYSOBLEPHUS 311, 340-1,
 346-7, 551
lophus, *Sparus* 340
 LOUTI, VARIOLA 542
 LUTIANIDAE 173, 285, 396, 532-535
- MACROLEPIS, MUGIL 89, 118-9*, 120, 131
 Pl. 20
macrolepis, *Mugil* 115, 118
 MACROPOMA 389, 425
 MACROSOMA, (DECAPTERUS) 175
 MADAGASCARIENSIS, ELEOTRIS 265
madagascariensis, *Sparus* 315
 MALACANTHIDAE 395
 MALACANTHUS LATOVITTATUS 395
 MARCGRAVIA 59
 MARCOSTOMUS, OPISTHOGNATHUS
 (= MACROSTOMUS, O) 164 Pl. 20
 MARGINATA, (SYNAPTURA) 6
 MARGINATUS, HEMIRHAMPHUS 22-3,
 27-29
marginatus, (*Hemirhamphus*) 24
 MARGINATUS, OPHICHTHYS 151
marginatus, *Ophiurus* 151
 MARLEYI, AMBLYAPISTUS 12
marleyi, *Amblyapistus* 543
 MARLEYI, CHAETODON 176-7 Pl. 22
 MARLEYI, TAENIOLABRUS 256-8 Pls. 1, 2
 MARLEYI, THYRSITOIDES 291-2
 MATSUBARE, DENTEX 367
 MEDITERRANEUS, (HOPLOSTETHUS)
 162
 MEDUSOPHAGUS, SCHEDOPHILUS 55-7
 Pl. 5
 MELANURA, SARDINELLA 150-1
melinopterus, *Mugil* 125, 128
 MENTALIS, CLINUS 197, 297
 MERLUCCIUS CAPENSIS 158, 206
 MESOPRION, (NEMIPTERUS) 401-2
 MICRODON, DERMATOPSIS 568
microdon, *Gymnocranius* 536-7
 MICRODON, PRISTIPOMOIDES 287
microlepis, *Spondyllosoma* 362
 MICROPHIS BRACHYURUS 49*, 50
 MICROPTERUS SALMOIDES 237
Micropus zeylonicus 13
 MICRURA, (PTEROPLATEA) 43-4
miles, *Dentex* 370, 373
 MOBULA DIABOLUS 561, 569
Mobula kuhli 569
 MOBULIDAE 568
 MOFFATI, HAPLOCHROMIS 230 Pl. 32
 MONACANTHIDAE 206, 238-240
 MONACANTHINAE 238
 MONACANTHUS SETIFER 206-7 Pl. 19
 MONACANTHUS, SYNCHIROPUS 165
 MONOCEROS, ALUTERES 238, 240, 241-4
 Pls. 40, 41, 42

- MONOCEROS UNICORNIS 51, **187**
 MONODACTYLIDAE 218, **235**
 MONODACTYLUS **235**
 MONODACTYLUS FALCIFORMIS **235**
 Pl. 34
 MONOGRAMMA, SCOLOPSIS 51
 MONOTAXIS 534-5, **542**
 MORMYRUS, LITHOGNATHUS 311, 355,
 356* Pls. 20, 29
 MOSSAMBICA, ANGUILLA **227**
 MUGIL 44, 77-83, 85*, 87*, (130), 231
Mugil auratus 80-1, 106, 108, 120, 122-3
Mugil belanak 129
Mugil borneensis 120
 MUGIL BUCHANANI 81-2, 89, **113-4*-5**,
 131 Pls. 16, 20
 MUGIL CAERULEOMACULATUS 128,
130-1
Mugil caeruleomaculatus 95, 113, 115
 MUGIL CANALICULATUS 81-2, 89, 113,
120-2*-3, 130, 132 Pls. 16, 17, 18
Mugil capensis 108, 110
 MUGIL CAPITO 79, 83, 88, 102, **103-4*-5*-7**,
 110, 131 Pls. 17, 19
 MUGIL CEPHALUS 79, 81, 83, 88, **90-1*-5**,
 123, 130, 132 Pl. 15; p. **232***
Mugil ceylonensis 81, 113, 115
 MUGIL COMPRESSUS 81, 89, **115-7*-8**, 131
 Pls. 17, 20
Mugil constantiae 90
 MUGIL CRENILABIS 88, **99***, 100, 130,
 274-5
 MUGIL CUNNESIUS **129**, 130
Mugil cunnesius 81, 96, 98
Mugil diadema 81, 115, 117-8
Mugil engeli 97-8
 MUGIL EURONOTUS 81-4, 88, **100**, 101*-3,
 110, 123, 131, 133 Pls. 16, 17, 19; p. **232***, **233**
Mugil hoeferi 122
Mugil kelaartii 97-8
 MUGIL LABIOSUS **129**, 130
Mugil longimanus 96-8, 113
 MUGIL MACROLEPIS 89, **118-9***, 120, 131
 Pl. 20
Mugil macrolepis 115, 118
Mugil melinopterus 125, 128
Mugil multilineatus 108, 110
Mugil nepalensis 128
Mugil oeur 90, 92
 MUGIL OLIGOLEPIS 81, 89, 118, **125-7*-8**,
 131 Pls. 21, 22
Mugil olivaceus 120
Mugil parsia 129
Mugil planiceps 129
 MUGIL ROBUSTUS 88-90, **93-4*-5**, 115,
 130-1 Pls. 21, 22
Mugil ruppellii 100
Mugil saliens 81, 100, 102, 106-8, 110
 MUGIL SEHELI 89, 95, **111-2*-3**, 123, 131
 Pls. 16, 18
 MUGIL SPEIGLERI 128-9-130
Mugil speigleri 81, 120, 122
 MUGIL STRONGYLOCEPHALUS 81, 83,
 88, 93, **96-7*-8**, 113, 130 Pls. 16, 18
 MUGIL TADE **129**, 130
 MUGIL TRICUSPIDENS 81, 83-4, 88, 93,
108-9*-10, 123, 131, 133 Pls. 17, 18
Mugil troscheli 120
 MUGIL WAIGIENSIS 89, **123-4*-5**, 131
 Pl. 20
 MUGILIDAE 41, 77, 218, **231**, 274
 MUGILIDAE, Abbreviated key to **130**
 MULLOIDES, NEMIPTERUS **399**, 400*-2
mulloides, *Nemipterus* 542
 MULTIFASCIATUS, DICHISTIUS 138-9,
 141, **144-6** Pls. 15, 16
multilineatus, *Mugil* 108, 110
 MULTIRADIATUS, DERMATOPSIS 568
 MULTISPINOSUS, LEPIDOTRIGLA 62,
66-7 Pls. 17, 20
 MUS, CLINUS 11, 297
 MYAPOSAE, HAPLOCHILUS 273
 MYCTOPHIDAE 17, 152
 MYCTOPHUM **17**
 MYCTOPHUM (DIAPHUS) ELUCENS
152-3*
 MYCTOPHUM (NASOLYCHNUS) FLO-
 RENTII **18** Pl. 9
 MYLIOBATIDAE 147
 MYLIOBATUS CERVUS **147-8***
Myxus 77-9, 81
Myxus barnardi 81, 90, 93

 NASOLYCHNUS **18**
 (NASOLYCHNUS) FLORENTII, MYCTO-
 PHUM **18** Pl. 9
 NASUTUS, CYMATOCEPS 311-2, **338-9***,
 382 Pls. 20, 25; p. 512
 NASUTUS, LIONURUS **154-5***
 NASUTUS, PAGRUS **182-3** Pl. 23
natalense, *Acanthidium* 272
natalensis, *Chrysophrys* 323, 547
 NATALENSIS, CUBICEPS 200
natalensis, *Dentex* 374
 NATALENSIS ISO **156-7**
 NATALENSIS, LEPIDOTRIGLA 62, 64, **65**
 Pls. 16, 18, 19
 NATALENSIS, PAGELLUS 311, **352-3*-4**
 Pls. 20, 29
natalensis, *Polysteganus* 376
 NATALENSIS, PTEROPLATEA **43-45***, 47
 Pl. 4
 NATALENSIS, TILAPIA **229** Pl. 32
 NAVALIS, NEMACOCLINUS **297-8**
 NEMACOCLINUS 298-9
 NEMACOCLINUS NEVALIS **297-8**
 NEMIPTERIDAE 399, 533-535, 542
 NEMIPTERUS **399**
 NEMIPTERUS DELAGOEAE **542**
 NEMIPTERUS MULLOIDES **399**, 400*-2,
 542
 NEOSCORPIS 6, 136, 137
 NEOSCORPIS LITHOPHILUS 7
 NEOTHUNNUS 187
 NEOTHUNNUS ITOSIBI **185***
nepalensis, *Mugil* 128
 NESIDES 421
 NIERSTRASZI, (PERISTEDION) 71
nigra, *Elacate* 177
nigripinnatus, *Chaetodon* 282, 284
 NIGROMARGINATUS, (OPISTHOGNA-
 THUS) 165
 NOCT, (DIPLODUS) 331
 NUFAR, CHEIMERIUS 368, **370-1*-3** Pls.
 21, 27
nufar, *Dentex* 370-1, 373

- nufar*, *Polysteganus* 371
- obliteratus*, (*Aluterus*) 241
oeur, *Mugil* 90, 92
OLIGOLEPIS, **MUGIL** 81, 89, 118, **125–7***–8,
 131 Pls. 21, 22
olivaceus, *Mugil* 120
ONCHOCEPHALIDAE 211
OPERCULARE, **POMADASYS** **179**–182
OPERCULARIS, **PTERAGOGUS** **289**, **290***
OPHICHTHYIDAE 151, 273
OPHICHTHYS MARGINATUS **151**
OPHIOCEPHALUS, **ELEOTRIS** 265
Ophiurus marginatus 151
OPISTHODON, **GRAMMONUS** **52** Pl. 4
OPISTHOGNATHIDAE 164
OPISTHOGNATHUS MARCOSTOMUS
 (= **MACROSTOMUS**) **164** Pl. 20
ORBICULARIS, (**PLATAX**) 249
orbis, *Chaetodipterus* 188, 250
ORBIS, **TRIPTERODON** **187**–8, 245, 248–
250*–2 Pls. 21–23; p. **542**–3
ORNATUS, **CLINUS** 11, 197, 297
Osbeckia 240
Osbeckia scriptus 243
OSTRACION 210
OSTRACIONTIDAE 209
Ostracion turrinus 209
OXYLOPHIUS, **TROPIDICHTHYS** **15** Pl. 16
- PACHYMETOPON** 305, 311, 357, **362**, 364,
 526
PACHYMETOPON AENEUM 311, 363, **364**
 Pls. 22, 29; p. 526
PACHYMETOPON BLOCHII 311, **363**, 364
 Pls. 22, 28, 29
PACHYMETOPON CANESCENS 311, **363**–4
PACHYMETOPON GIBBOSUM **526**–7
PACHYMETOPON GLAUCUM 311, 363,
 365, 366
PACHYMETOPON GRANDE 311, 363,
 365–6, 526
Pachynathus conspicillum 210
PAGELLINAE 310–11, **350**
PAGELLUS 304–5, 311, 351, **352**, 354
PAGELLUS LITHOGNATHUS 182
PAGELLUS NATALENSIS 311, **352**–3*–4
 Pls. 20, 29
PAGRUS 183, 304–5, 317, 319, 349
PAGRUS CILIARIS 334
PAGRUS NASUTUS **182**–3 Pl. 23
PALMIETENSIS, **BROTULA** **198** Pl. 21
PALUDINOSUS, **BARBUS** 219, **221** Pl. 30
PAPYRICHTHYS 49, **53**–4
PAPYRICHTHYS PELLUCIDUS **54**–5 Pl.
 6A
PARAPERCIS PULCHELLA **276**–7*–9
Parapercis robinsoni 279
PARASCORPIS 136
parmatus, (*Setarches*) 57–8
parsia, *Mugil* 129
PAVO, **CLINUS** 11, 297
PEAOLOPESI, **GLAUCOSOMA** **396**–7*
Pelecinomimus 159
Pelecinomimus picklei 158
PELLUCIDUS, **PAPYRICHTHYS** **54**–5 Pl. 6
pellucidus, *Psenes* 53–4
- PENTAPODIDAE** 534, **535**, **542**
PENTAPODUS 534–6, **541**
PERISTEDION 61, **69**
PERISTEDION ADENI 69, **71**–3 Pl. 22
Peristedion gracile 69–71
PERISTEDION WEBERI **69**–71, 73 Pl. 21
PERONII, **DENTEX** 367
PETRAITES 299
Petraites 197
Petraites laurentii 196
PETROSCIRTES TAPEINOSOMA 51, **191**–2
 Pl. 21; p. 296
PETRUS 366–8, **380**–1
PETRUS RUPESTRIS 368, **381**, **382*** Pls. 21,
 27
PICKLEI, **CETOMIMUS** **158**–9
picklei, *Pelecinomimus* 158
PINGUIPEDIDAE 276
PINNATUS, (**PLATAX**) 249
PISOODONOPHIS BORO **273**
planiceps, *Mugil* 129
PLATACIDAE 187, 247, **248**, 542
PLATACINAE 247, **248**
PLATAX 137, 245–**249**, 252
PLATYCEPHALIDAE 204
PLATYCEPHALUS INDICUS **204**–6 Pl. 20
Platycephalus insidator 204
PLECTORHYNCHIDAE 50, 179, 287
PLOTOSIDAE **218**, 226
PLOTOSUS ANGUILLARIS **226** Pl. 34
POLYAMBLYODON 305, 311, 357, 362, **366**,
 526–8
POLYAMBLYODON GERMANUM 311,
 366
 (**POLYAMBLYODON**) **GERMANUS**,
POLYAMBLYODON 527, **528**
POLYAMBLYODON (LEPTOMETOPON)
CRISTICEPS 527*, **528**, 529*, 530*–2 Pl. 50
POLYAMBLYODON (LEPTOMETOPON)
GIBBOSUS **528**, 531
POLYAMBLYODON (POLYAMBLYO-
DON) GERMANUS 527, **528**
POLYPTERUS 501
POLYSTEGANUS 367–8, 371, **373**–4, 378–380
POLYSTEGANUS ARGYROZONA 308*,
 368, 374, **378**
POLYSTEGANUS COERULEOPUNCTA-
TUS 368, 373, **374**–6 Pls. 22, 28
Polysteganus natalensis 376
Polysteganus nufar 371
POLYSTEGANUS PRAEORBITALIS 368,
 374, **379**, **380*** Pls. 21, 28
POLYSTEGANUS UNDULOSUS 368, 374,
 376–7* Pls. 21, 28; p. 556
POMADASYS OPERCULARE **179**–182
Pomadasyis striatus 288–9
POMADASYS STRIDENS **287**–9
POMADASYS SUILLUM **181**
POMATOMUS SALTATOR 186
PORCOSTOMA 311, 314, **348**
PORCOSTOMA DENTATA 311, **349**, 350
 Pls. 20, 25
PRAEORBITALIS, **POLYSTEGANUS** 368,
 374, **379**, **380*** Pls. 21, 28
PRIONOLEPIS 1
PRIONOLEPIS HEWITTI 1, 3*
Prionolepis hewitti 187
PRIONOSPARUS **546**, 548
PRISTIOPHORUS 253

PRISTIPOMOIDES 287
 PRISTIPOMOIDES ARGYROGRAM-
 MICUS 285-6*-7
Pristipomoides filamentosus 287
 PRISTIPOMOIDES MICRODON 287
 PSAMMOGOBIUS 193
 PSAMMOGOBIUS KNYSNAENSIS 193-4
 PSENEs 53, 200
 PSENEs INDICUS 53
Psenes pellucidus 53-4
 PSENEs WHITELEGGII 199, 200 Pl. 19
 PSEUDALUTERES 240
 PTERAGOGUS OPERCULARIS 289, 290*-1
 PTEROGYMNUS 310-11, 314, 335
 PTEROGYMNUS LANIARIUS 311, 335,
 336*-7 Pls. 19, 25; p. 526
 PTEROPLATEA 43
 PTEROPLATEA NATALENSIS 43-5*-7 Pl.
 4
 PULCHELLA, PARAPERCIS 276-7*-9
 PUNICEUS, CHRYSOBLEPHUS 311, 340-1,
 343-4*-5, 526, 551-2, 554-5*-6
 PUNTAZZO 305, 311, 313, 330
 PUNTAZZO PUNTAZZO 311, 330
 PUNTAZZO, PUNTAZZO 311, 330

QUADRICORNIS, LACTOPHRYS 209 Pl.
 22
 QUADRISPINOSUM, ACANTHIDIUM
 270-1*-2
 QUEKETTI, CHELIDONICHTHYS 68*

regani, (*Cetomimus*) 158
 REYNALDI, (HEMIRHAMPHUS) 31
 RHABDODERMA 425
 RHABDOSARGUS 321, 546
 RHACHICENTRIDAE 177
 RHACHICENTRUM CANADUS 177-8
Rhynchorhamphus 21-2
 RIVERS-ANDERSONI, (PERISTEDION) 71
rivulatus, *Dentex* 533, 537, 541
rivulatus, *Gymnocranius* 533
 ROBINSONI, (ACANTHOPAGRUS) 317
robinsoni, *Dentex* 533, 537
 ROBINSONI, GYMNOCRANIUS 368, 369
 Pls. 21, 27
robinsoni, *Gymnocranius* 533, 536-7, 541
 ROBINSONI, HOPLEGNATHUS 169-70 Pl.
 18
robinsoni, *Parapercis* 279
 ROBUSTA, AXELIA 501, 505
 ROBUSTUS, CLINUS 196, 297
 ROBUSTUS, MUGIL 88-90, 93-4*-5, 115,
 130-1 Pls. 21, 22
 RUPPELLII, GYMNOCRANIUS 533, 537,
 541
ruppellii, *Mugil* 100
rupestris, *Dentex* 371
 RUPESTRIS, PETRUS 368, 381-2* Pls. 21, 27

Salarias 191
Salarias sexfasciatus 190-1
saliens, *Mugil* 81, 100, 102, 106-8, 110
 SALMO 236
 SALMO FARIO FARIO 236, 237
 SALMO FARIO IRIDEUS 236, 237

SALMOIDES, MICROPTERUS 237
 SALMONIDAE 218, 236
 SALPA, SARPA 311, 360
 SALTATOR, POMATOMUS 186
 SAMMARA, HOLOCENTRUM 275 Pl. 11
 SARBA, AUSTROSPARGUS 311, 319, 320-
 323-4*, 327-8 Pls. 18, 23; p. 545-547-9
sarba, *Austrospargus* 325
sarba, *Chrysophrys* 547
 SARBA, SPARGUS 44, 141, 547
 SARDA CHILENSIS 293, 294*-5
 SARDA SARDA 295
 SARDA, SARDA 295
 SARDINELLA MELANURA 150-1
 SARGUS, DIPLODUS 311, 320, 331-2* Pls.
 19, 24
 SARGUS HOLUBI 327
 SARPA 305, 311, 357, 359
 SARPA SALPA 311, 360
 SASSENIA 425
 SCANDENS, ANABAS 230
Scarostoma 170
 SCATHARINAE 310-1, 357
 SCHEDOPHILUS 54, 56
 SCHEDOPHILUS MEDUSOPHAGUS 55-7
 Pl. 5
 SCHLEGELI, HEMIRHAMPHUS 22, 24,
 35-39, 40
schlegeli, *Hemirhamphus calabaricus* 39
 SCLATERI, GEPHYROGLANIS 226 Pl. 33
 SCOLOPSIS MONOGRAMMA 51
 SCOLOPSIS VOSMERI 50
 SCOMBEROMORUS LINEOLATUS 188-9
 SCOMBRIDAE 185, 187-8, 293
 SCORPAENA KOWIENSIS 202-3
 SCORPAENIDAE 12, 57, 201-2, 543
 SCORPIDIDAE 6, 135-7, 247
 SCORPIS 6
 SCRIPTUS, ALUTERES 240-1, 243-4 Pl. 42
scriptus, *Osbeckia* 243
 SCULLYI, (BLENNIUS) 189
 SCYLLIORHINICEPS, ECKLONIA-
 ICHTHYS 561-2*-3
 SCYMNORHINUS 253
 SCYMNORHINUS BREVIPINNIS 253-4*-5
 SCYMNORHINUS LICHIA 255
Scymnorhinus lichia 255
 SCYMNORHINIDAE 253
 SCYMNUS 253
 SEHELI, MUGIL 89, 95, 111-2*-3, 123, 131
 Pls. 16, 18
Semathunnus 187
 SENTICEPS, BARBUS 219, 220*, 266*
 SERRANIDAE 167, 542
 SERRANUS KNYSNAENSIS 167
 SETARCHES GÜNTHERI or GUENTHERI
 57-8 Pl. 6
 SETIFER, CHAETODON 247
 SETIFER, MONACANTHUS 206-7 Pl. 19
sexfasciatus, *Salarias* 190-1
 SINUOSA, WIMANIA 500
 SMITHII, (MICROPHIS) 50
smithii, (*Mugil*) 118
 SOLEIDAE 4
 SPARIDAE 135-7, 182, 303-308*-10, 337,
 525-6, 532-534, 536, 545
 SPARIFORMES 534
 SPARINAE 310-312-3
 SPARODON 311, 313, 315, 327-8

- SPARODON DURBANENSIS 311, 321, 328-9*, 330 Pls. 18, 23
 SPARRMANI, TILAPIA 229 Pl. 32
 SPARUS 183, 304-5, 313-321, 328-331, 334-5, 340, 349, 545
Sparus durbanensis 328
Sparus lophus 340
Sparus madagascariensis 315
 SPARUS SARBA 44, 141
Sparus sarba 547
 SPEIGLERI, MUGIL 128, 129-30
speigleri, *Mugil* 81, 120, 122
 SPINIFER, ARGYROPS 311, 333, 334-5 Pls. 20, 25; p. 525
 SPONDYLIOSOMA 305, 311, 357, 362-3
 SPONDYLIOSOMA EMARGINATUM 311, 362 Pls. 22, 29
Spondyliosoma microlepis 362
 SQUALIDAE 253, 270
 STELLATUS, (TETRODON) 208
 STENOBOBIUS 263
 STRIATUS, CLINUS 11, 197, 297
striatus, *Pomadasys* 288-9
 STRIDENS, POMADASYS 287-9
 STROMATEIDAE 49, 53, 199
 STRONGYLOCEPHALUS, MUGIL 81, 83, 88, 93, 96-7*-8, 113, 130 Pls. 16, 18
 SUILLUM, POMADASYS 181
 SUPERCILIOSUS, CLINUS 11, 197, 297
 SYNAGRIS 399
 SYNANCEIA 543
 SYNANCEIA HORRIDA 543-4
 SYNANCEIA VERRUCOSA 543-4
 SYNANCHIDAE 13, 543
 SYNAPTURA BARNARDI 4, 5* Pl. 16
 SYNCHIROPUS MONACANTHUS 165
 SYNGNATHIDAE 49, 149
- TADE, MUGIL 129-30
 TAENIOIDES 564
 TAENIOIDES JACKSONI 564-5*-6
 TAENIOLABRUS 256
 TAENIOLABRUS MARLEYI 256*-8 Pls. 1, 2
 TAENIONOTUS, (AMBLYAPISTUS) 13
Taius 367, 373
 TAPEINOSOMA, PETROSCIRTES 51, 191-2 Pl. 21; p. 296
 TAURUS, CLINUS 196, 297
teira, (*Platax*) 249
 TELEOSTEI 215-217*
 TESTUDINEUS, ANABAS 230
 TETRODON LAGOCEPHALUS 207-8 Pl. 22
 TETRODONTIDAE 15, 207
 TEUTHIDIDAE 187
Tholichthys 284
 THYRSITOIDES MARLEYI 291-2
 TILAPIA 228-9, 230
 TILAPIA NATALENSIS 229 Pl. 32
 TILAPIA SPARRMANI 229 Pl. 32
 TOBYEI, (MYLIOBATIS) 147
 TORVUS, CONGIOPODUS 51
 TRACHELOCHISMUS 561
 TRACHICHTHYIDAE 160
 TREVELYANI, BARBUS 219 Pl. 29
 TRICHONOTIDAE 256
 TRICUSPIDENS, AUSTROSPARUS 546, 548-9
- TRICUSPIDENS, MUGIL 81, 83-4, 88, 93, 108-9*-10, 123, 131, 133 Pls. 17, 18
 TRIFASCIATUS, CHAETODON 280-1
 TRIFASCIATUS, DIPLODUS 311, 331, 332-3* Pls. 19, 24
trifascigula, *Blennius* 295
 TRIGLA 61, 73-4
 TRIGLA (TRIGLA) 73
 (TRIGLA), TRIGLA 73
 TRIGLA (TRIGLOPORUS) 61, 73-4
 TRIGLA (TRIGLOPORUS) AFRICANA 75, 74-6 Pl. 23
 TRIGLIDAE 61
 TRIGLOPORUS 61, 73-4
 (TRIGLOPORUS) AFRICANA, TRIGLA 73, 74-6 Pl. 23
 (TRIGLOPORUS), TRIGLA 61, 73-4
 TRIPTERODON 137, 245-249, 304
 TRIPTERODON ORBIS 187-8, 245, 248-250*-2 Pls. 21-23; pp. 542-3
 TROPIDICHTHYS OXYLOPHIUS 15 Pl. 16
trosceli, *Mugil* 120
turritus, *Ostracion* 209
- UMBRATUS, LABEO, 224, 225 Pl. 31
 UNDULOSUS, POLYSTEGANUS 368, 374, 376-7* Pls. 21, 28; p. 556
 UNICORNIS, MONOCEROS 51, 187
unifasciatus, (*Hemirhamphus*) 33, 36, 38, 40
- VAGUS, (ACANTHOPAGRUS) 314
 VAILLANTII, (PTEROPLATEA) 46
 VALENCIENNI, (PTEROPLATEA) 46
variabilis, *Dentex* 371
 VARIOLA LOUTI 542
 VENUSTRIS, CLINUS 196, 297
 VERRUCOSA, SYNANCEIA 543-4
vespertilio, (*Platax*) 249
 VESPOSUS 1
vicinus, *Anabas* 231
 VONBONDEI, GOBIUS 259-261* Pls. 3, 5
 VOSMERI, SCOLOPSIS 50 Pl. 5
 VULPES, ALBULA 51
 VULNERATUS, BARBUS 219, 223 Pl. 31
- WAGIENSIS, MUGIL 89, 123-4*-5, 131 Pl. 20
 WEBERI, PERISTEDION 69-71, 73 Pl. 21
 WHITEIA 425
 WHITELEGGII, PSENIEN 199, 200 Pl. 19
 WIMANIA 425, 447
 WIMANIA SINUOSA 500
- XANTHOCEPHALUS, CHAETODON 282-3*
 XENOLEPIDICHTHYS 1
 XENOLEPIDICHTHYS DALGLEISHI 162-3 Pl. 18
- ZEBRATUS, GALAXIAS 236 Pl. 34
zeylonicus, *Amphiprionichthys* 13
 ZEYLONICUS, CARACANTHUS 13
zeylonicus, *Micropus* 13

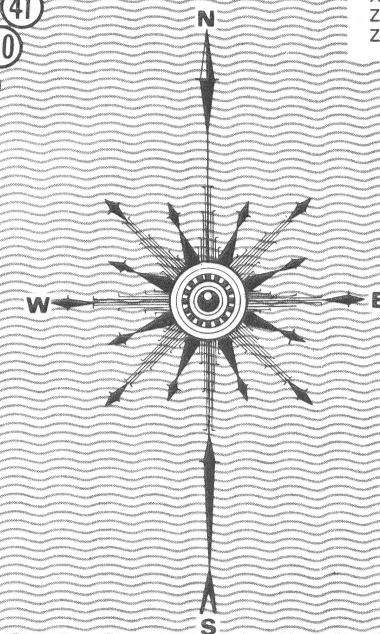
SOUTHERN AFRICAN SEAS

Agulhas Cape, 13
 Algoa Bay, 20
 Amanzimtoti, 37
 Bashee, 29
 Bazaruto Island, 51
 Beira, 52
 Bredasdorp Coast, 14
 Buffalo River, 26
 Bushmans River, 22
 Camps Bay, 8
 The Cape, 9
 Cape Agulhas, 13
 Cape of Good Hope, 9
 Cape Padrone, 21
 Cape Point, 9
 Cape Town, 7
 Chalumna River, 25
 Dassen Island, 6
 Delagoa Bay, 49
 Durban, 39
 East London, 26
 False Bay, 12
 Fish Point, 24
 Great Fish Point, 24
 Great Kei River, 27
 Inhaca, 47
 Inhambane, 50
 Isipingo, 38
 Kalk Bay, 10
 Kei Mouth, 27
 Kei River, 27
 Knysna, 17
 Kowie River, 23
 Kosi Bay, 45

1 Swakopmund
 Walfish Bay
 2 Port Nolloth
 3 Lamberts Bay
 4 St. Helena Bay
 5 Saldanha Bay
 6 Dassen Island
 7 Cape Town
 8 Camps Bay
 9 The Cape
 Cape of Good Hope
 Cape Point
 10 Kalk Bay
 11 Simons Bay
 12 False Bay
 13 Cape Agulhas
 14 Bredasdorp Coast
 15 St. Sebastian Bay
 16 Mossel Bay
 17 Knysna
 18 Plettenberg Bay
 19 Tsitsikama
 20 Algoa Bay
 21 Cape Padrone
 22 Bushmans River
 23 Kowie River
 Port Alfred
 24 Great Fish Point
 25 Chalumna River
 26 Buffalo River
 East London

27 Kei Mouth
 Great Kei River
 28 Transkei
 29 Bashee
 30 Xora River
 31 Umtata River
 32 Umgazi River
 33 Port St. Johns
 34 Pondoland
 35 Port Shepstone
 36 Umkomaas River
 37 Amanzimtoti
 38 Isipingo
 39 Durban
 Umgeni River
 40 Umhlanga
 41 Tugela River
 42 Zululand
 43 Richards Bay
 44 St. Lucia Bay
 45 Kosi Bay
 46 Maputoland
 47 Inhaca
 48 Ponte Mahone
 Ponte Maone
 49 Delagoa Bay
 Lourenço Marques
 Polana
 50 Inhambane
 51 Bazaruto Island
 52 Beira
 53 Zambezi River

Lamberts Bay, 3
 Lourenço Marques, 49
 Maputoland, 46
 Mossel Bay, 16
 Plettenberg Bay, 18
 Polana, 49
 Pondoland, 34
 Ponte Mahone, 48
 Ponte Maone, 48
 Port Alfred, 23
 Port Elizabeth, 20
 Port Nolloth, 2
 Port Shepstone, 35
 Port St. Johns, 33
 Richards Bay, 43
 St. Helena Bay, 4
 St. Lucia Bay, 44
 St. Sebastian Bay, 15
 Saldanha Bay, 5
 Simons Bay, 11
 Swakopmund, 1
 Transkei, 28
 Tugela River, 41
 Tsitsikama, 19
 Umgazi River, 32
 Umgeni River, 39
 Umhlanga, 40
 Umkomaas River, 36
 Umtata River, 31
 Walfish Bay, 1
 Xora River, 30
 Zambezi River, 53
 Zululand, 42



J. L. B.
SMITH

I
C
H
T
H
Y
O
L
O
G
I
C
A
L

P
A
P
E
R
S

1931-
1943

Vol. 1

J.L.B.S.
Inst. Ich

